207446
LIBRARY OF CONGRESS
JUL 8 1890
SMITH

THE AMERICAN

GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LIII.—No. 1. Whole No. 787. | NEW YORK, MONDAY, JULY 7, 1890. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y. AS SECOND CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, N.Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.50 (19 shillings—22½ francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post-office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C.O.D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

EDITORIALS—

Obituary—General Charles Roome..... 1

The Market for Gas Securities..... 2

*The Claus Process, by Mr. G. Tredway Thompson..... 2

*Hyde's Patent Overflow Gate and Liquid Separator..... 4

Competition in Gas Supply and the Invariable Result, by Mr. Frederic Egner..... 5

The Mannesmann Process for Making Seamless Tubes, by J. G. Gordon..... 6

Gas Chatter, by a Pleased Consumer..... 9

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 11

Annual Meeting, Mt. Holly, N. J.—Mr. Egner as a Humanitarian—Rejecting the Bids, Electric Lighting, New York City—Raising the Valuation—Clamond Gas Burner Company, Jersey City, N. J.—The Roanoke Company's Dividend—Purchased the Hopper Patents—Mr. Taber Resigns—Public Lighting, Worcester, Mass.—Suit for Salary—The Stock was Appraised—The Belleville (Ills.) Company to Engage in Electric Lighting—A Well-Worded Circular—The Natick (Mass.) Company Follows Suit—Cheaper Gas for Alexandria, Va.—Commissioner Coffin Sails for Europe—The Wakefield (Mass.) Company Secures the Prize—And Many Other Items.

Spiral Weld Pipe for Gas Distribution, by Col. J. A. Price..... 13

OBITUARY—GENERAL CHARLES ROOME.

Again are we called upon to chronicle the death of a member of the fraternity, whose name has been to us a household word, and whose fame as an engineer, and in other prominent walks of life as well, exacted recognition abroad as well as at home. The shining mark thus pierced by the arrow of death was General Charles Roome, who, after many months if not years of failing health, gave way to the inevitable, at his home (No. 29 West 52d street) in this city, on the afternoon of Saturday, June 28th, at the ripe age of 78 years. Since fine gold needs not gilding to emphasize its value, we hasten to place before our readers the main facts connected with his life, permitting these to tell the simple story of his career, always replete with sterling candor and worth.

The founder of the Roome family in America came to New York city in 1684, and the direct descent is unbroken up to the present day, three surviving children—a daughter and two sons—of the deceased General being now resident here. Deceased was the son of Nicholas Roome, who at the time of the birth of deceased was Superintendent of the "Old State Prison"—then located in this city, on the site of what has for years been covered by the buildings of a famous brewing house—and was born on the 4th of August, 1812. He was one of a family of 20 children, of whom he was also the last living representative. Having received the advantages of a common school education, he first turned his attention to mercantile business, meeting therein with varied success, up to 1837, when the growth of the traffic of the Manhattan Gas Light Company opened up to him the opportunity to become attached to its engineering staff, The position of Assistant to Engineer Page was offered to and accepted by him. Observant and attentive, no detail of his new sphere of life was too small to remain uninvestigated by him, and the result was that in 1842 he was named Engineer-in-Chief to the Company. He handled the affairs of the Company in such masterly fashion as to attract the attention of the capitalists who controlled the corporation, and in January, 1854, he was named to the Presidency, succeeding in that position Mr. Henry Young, a name well known and respected in that period of the history of gas lighting. The General acted as President of the Company up to the time of the merger which resulted in the formation of the Consolidated Gas Company, in 1884. He then was elected President of the latter corporation, retaining the office until 1886, at which time the burden of years with their penalty or inheritance of physical waning prompted him to decline a re-election. His confreres, however, refused to relieve him of all active duty, and he reluctantly agreed to serve on the Directorate, and to act as Chairman of the Executive Committee, which places he occupied at the time of his decease.

Thus it will be seen how simply concerted was the tone of his business life. But seemingly simple on its face, complex in all conscience it was, when we remember how wonderfully rapid and kaleidoscopic were the changes that occurred in the development and growth of the gas supply of the metropolis, particularly in the two score of years ended a decade ago. These shifting scenes, ever on the side of magnitude, required that the one who provided for their emergencies should be the possessor of peculiar powers of mind and body, and that the General was so endowed

requires no presentation of proof from us. The record of the Manhattan Gas Light Company is more than ample in its testimony to the engineering ability and executive direction of the guiding hand that held the helm. While no great revolution in the arts or processes of gas manufacture can be traced to the fertile mind of deceased, it is still beyond question that to him may be given the credit of never having maintained the barriers of reserve against his fellow-craftsmen. The yards or the interiors of the Manhattan gas works were never closed to those of the fraternity who in these days of the evolution of a new industry were anxious to discover wherein their own methods of working might be bettered. No; the freedom of his works and his best faculty of explanation were ever at the full and free command of those who visited the one or sought the other.

Turning from his active business life to the record of his connection with the associations formed to further the best interests of the gas fraternity, we find that he was one of those who, in April, 1873, visited Knickerbocker cottage in response to the now historical call, issued by Messrs. P. E. DeMill, E. T. Watkins and T. C. Montgomery, for a conference as to the advisability of forming an American Association of Gas Engineers. At that conference the General was called to preside, and to his firmness then and subsequently, at times when it almost seemed as if the Association's hold upon existence must be broken, are we, in our opinion, indebted for our Associations as they stand to-day. He was elected to the Presidency of the American Association at the initial conference, but did not preside at the first annual meeting (New York, Oct., 1873), owing to his absence in Europe, his trip being undertaken for the purpose of benefiting his health, then for the first time showing signs of impairment. Though absent he nevertheless held the hearts and minds of his associates, who unanimously re-elected him to the Presidency. These honors were repeatedly conferred on him, until the occasion of the seventh annual meeting (Phila., 1879) when he peremptorily declined a re-election. Anxious to do all honor to their leader the Association thereupon elected him as their first Honorary Member. He was elected to Honorary Membership in the New England Association, at the meeting held in Boston, February, 1877, and was placed on the Honorary roll of the Society of Gas Lighting, in 1884. And thus did his associates delight to show their appreciation of his ability and worth.

Turning aside from his connection with the gas industry, we find that the Engineer and the Executive found time to serve his country in her hour of peril. In the dark days of September, 1861, he organized the 37th New York Volunteers, of which body he was chosen Colonel. The regiment was mustered into service September, 1862, and served in Maryland and Pennsylvania for three months, when they were recalled to New York city. In May, 1863, the regiment was again ordered to the front, to be recalled the following July to New York to assist in quelling the draft riots then convulsing the city. The regiment remained in New York until the expiration of the enlistment term. In recognition of these services Colonel Roome was brevetted a Brigadier-General of Volunteers, the commission being issued by President Andrew Johnson, we think in 1865. Prior to his active services in the war he was a member of the old Seventh Regiment, State Militia, and in that body attained the rank of Captain of Company D. He was also one of the incorporators of the Veteran Association.

Necessarily in his time and day he was connected with many benevolent, social and business institutions, and it is needless to add that his part in these was that of prominence. The three most cherished posts thus held by him were perhaps his Presidency of the St. Nicholas Society and his memberships in the American Institute and the Society of Mechanics and Tradesmen.

His distinguished connection with the Masonic Order was of the most brilliant kind. In fact no other man connected with the craft in this country has ever gained greater honor or promotion, as a simple enumeration of the posts filled by him will show. He was Past Master of Kane Lodge, No. 450; Past Grand Master of the Grand Lodge, State of New York; member and Past High Priest of Jerusalem Chapter, No. 8; member and Past Commander of the Coeur de Lion Commandery, Knights Templar; Past Grand Commander of Knights Templar, State of New York; Past Grand Master of the Grand Encampment, Knights Templar, United States; and honorary member, thirty-third degree, Scottish Rite, Northern and Southern Masonic Jurisdiction.

Many other important niches in public and private life were adorned by deceased, who in his thoroughness answered every demand and fulfilled every promise.

And so, full of years burdened with rich harvests of sound grain, General Roome has passed over to the majority in ripe fullness of years.

The following account of the funeral services is from a local authority, under date of July 2d:

The funeral of Gen. Charles Roome, which took place yesterday at St. Thomas's Church, Fifth Avenue and Fifty-third street, was very fully attended, and was an unusually impressive ceremony. Gen. Roome's personal friends who were present included not only those whom he had met in the social and business walks of life but scores of those who had know him through his long standing and honorable connection with Freemasonry, and they embraced representatives of nearly all the leading Masonic organizations in this part of the State, as well as most of the officers of the Grand Lodge.

On the arrival of the casket at the church door the officiating clergymen, the Rev. Dr. John Wesley Brown, assisted by the Rev. Henry Kirby, the Rev. Charles R. Treat, and the Rev. Dr. C. H. Hall of Brooklyn, proceeded down the aisle to meet it. The processional on the organ, "The Dead March in Saul," was then played by Organist William C. Macfarlane, and the service was opened with the impressive words of the Episcopal ceremonial, "I am the Resurrection and the Life." The casket was followed to the altar by the pall bearers—James W. Smith, President of the Consolidated Gas Company; Dr. James A. Bennett, Col. O. D. Ashley, the Right Worshipful Royal E. Deane of Kane Lodge, Charles E. Gregory, John P. S. Gobin, Deputy Grand Master William Sherer, and Charles T. McClenachan, Commander in Chief of the New York Consistory, Scottish Rite Masons.

Then came members of Gen. Rroome's family and a number of personal friends, while Kane Lodge, No. 454, F. and A. M., of which the deceased was a member, completed the cortege, there being nearly 70 members of this body present attired in their Masonic regalia. Among them were Worshipful Master Rollin M. Morgan, Worshipful Secretary Henry W. Penoyer, Right Worshipful Edward L. Gaul, Most Worshipful J. Edward Simmons, Worshipful Charles H. Haswell, and Worshipful William M. Hoes. Kane Lodge was the only organization which was present as a body, though many other prominent Masons attended. Among them were Past Grand Master John Little, Theophilus Pratt, Trustee of the Masonic Asylum fund, Past Master James Fuller, Past Grand Master Elwood E. Thorne, Grand Secretary E. M. L. Ehlers, Grand Commander John H. Worthington, Gen. J. H. Hobart Ward, Past Grand Librarian John G. Barker, Past Grand Treasurer John G. Boyd, Judge J. J. Gorman, Grand Treasurer; members of the Adelphic Council, No. 7, R. and S. M., including Master Frederick Kanter, Deputy Master George E. W. Stivers, T. F. Russell, Recorder John W. Coburn, Treasurer A. B. Price, F. E. Davis, Thomas Darling, Marshal J. Harvey Connell, Steward R. B. Brinckerhoff, and Sentinel John Hoole. There were also present many prominent representatives of the gas industry, the assemblage of all numbering not less than 2,000.

The musical portion of the services was unusually fine, being rendered by Organist Macfarlane with the assistance of the St. Thomas choir, Mrs. Marie Gramm, soprano; Miss Emily Winant, contralto; Clinton Elder, tenor, and William R. Squire, bass. The anthem chanted was followed by Hymn 514, "Art Thou Weary?" Hymn 512, "Lead, Kindly Light"; the anthem "I Heard a Voice," and the Masonic funeral hymn. The recessional was Beethoven's Funeral March.

The interment took place at Greenwood, where Masonic funeral services were rendered by Kane Lodge.

The Market for Gas Securities.

Dullness was the feature of the week, intensified, of course, by the closing of the banks, etc., from noon of Thursday. The tone of the market, however, was beyond doubt in the direction of strength, and we would advise purchases of Consolidated gas at anything under 103. It is more than probable that the next dividend will be at the rate of 6 per cent., which should send the shares to 112. Mutual and Equitable are inclined to higher prices, and Standard is not by any means friendless. Brooklyn securities are about as before, with a dull though strong market. There is little reason for doubting that the Chicago dividend will be paid on the 15th, and the shares are exceptionally strong at 57¼ to ¼. Laclede common is higher, but Baltimore Consolidated seems to have lost all life. It is at any rate listless, at 51¾ to 52.

WE understand that Mr. Caldwell, of Philadelphia, will be chosen President of the new Anglo-American Gas Company, the incorporation of which, at Trenton, N. J., last June was mentioned in our columns. It is quite certain that the policy which has hitherto dominated the practices of the United Gas Improvement Company will rule in the new corporation. In fact, the latter is but an enlarged edition of the former.

[Prepared for the JOURNAL.]

The Claus Process.

By MR. G. TREDWAY THOMPSON, St. Louis, Mo.

This method for the purification of coal gas in closed vessels was first tried at the Windsor street works of the Birmingham (England) Corporation, dealing with 200,000 cubic feet per day. On the erection, by the Belfast Corporation, of apparatus to treat 2,000,000 cubic feet of their gas per day by this system, the plant at Birmingham was abandoned. As some of the practices at the Ormeau Road gas works at Belfast affect the operation of the Claus Process, a brief description of these is necessary.

The works are in two sections, and have a maximum output of about five and one-half millions per day. The coal is carefully weighed into the works, but that is the last estimation it receives until the year's end, when the stock on hand is estimated, figuring 43 cubic feet per ton. A very striking feature in their retort house work is the fact that they have had no water or liquor in their hydraulic mains for five years. An ordinary wrought iron main was fitted for the dry seal system, by simply beveling the edges of the dips and fitting with ball-valves and levers, as shown in King's Treatise, Vol. I., p. 258, Fig. 260. After the first year of use the valves were examined and found as clean as when set. A stopped pipe is never experienced. The tar is immediately removed to the well by pipes in the bottom of the main; and the ball-valves are worked from below by the stokers. One accident has happened by its use. The exhauster is usually run at about half-a-tenth pressure on the so-called hydraulic; but at one time a slight vacuum was drawn, and on opening a dip too quickly an explosion followed which ripped up the main, though no one was injured.

The condensers and Livesey washers extract all the tar, and leave but about 0.5 per cent. of ammonia at the inlet of the Claus vessels. The Claus gas purification plant consists of five tower scrubbers, which, in the present two-million foot set, are each about 14′ diameter and 55′ working height. They are filled with large coke, in layers charged closely on iron grids. The gas enters at the bottom in an annulus around the outlet main from the upper portion of the scrubber, and each vessel has in connection a tank for its liquor, from which this is pumped to the next vessel in its course.

Having entered as described the gas goes through scrubbers No. 1 to 5 in numerical order, emerging clean. In No. 1 the CO_2 is mostly arrested: in No. 2, the H_2S; in No. 3, the CS_2; in No. 4, the remaining impurity other than ammonia, and in No. 5, the ammonia itself. The operation is thus: Spent liquor from the still of the ammonia recovery plant (to be described later) is distributed into No. 5, and by its affinity for NH_3 arrests and enters into solution with that gas—about 2 per cent. of which exists at this point—and passes to the tank below. Here it is mixed with very strong ammoniacal liquor from the ammonia condensers (also to be described hereafter), and the combined liquids are pumped to No. 4 scrubber, there to remove the traces of sulphur and acid impurities which have passed the three previous vessels as the gas moves. Then to No. 4 tank, then to No. 2 scrubber, where the free ammonia gases which have escaped liquefaction in the ammonia condensers enter and arrest the H_2S of the gas. From the tank of No. 2 the liquor goes to a small vessel called the sulphurizer, filled with solid sulphur, and carries a proportion of it forward to No. 3 scrubber, where the CS_2 is taken out.

Here, however, the dry main at the retort house appears as a factor. By unskilful or careless handling a variable amount of atmospheric air is drawn in at the dips, and this practically permits the bye-passing of the sulphurizer, though so irregularly as to be a hindrance rather than a help. I quote from a letter received from Mr. A. P. Hoskins, the assistant chemist in charge: "Our liquor contains both the normal ammonium sulphide $(NH_4)_2S$ and the acid sulphide, NH_4HS. When the sulphurizer is in use the action is: $(NH_4)_2S + S_x = (NH_4)_2S_{x+1}$, where x is any whole number from 1 to 6. When the polysulphides are obtained by oxidation, as by us at present, it is the acid sulphide which is oxidized, thus:

$$2(NH_4HS) + O = H_2O + (NH_4)_2S_2; \text{ or}$$
$$12(NH_4HS) + 3(O_2) = 6(H_2O) + 5(NH_4)_2S + (NH_4)_2S_7.$$

"These are the two limiting equations for the formation of polysulphides. * * * "I think it is clear that conditions of oxidation which will give $(NH_4)_2S_5$ and $(NH_4)_2S_7$ will also give the others" $(NH_4)_2S_3$, $(NH_4)_2S_4$, $(NH_4)_2S_5$, and $(NH_4)_2S_6$; "for instance, $(NH_4)_2S_3 + (NH_4)_2S_7 = (NH_4)_2S_5 + (NH_4)_2S_5$, or equals $(NH_4)_2S_4 + (NH_4S)_2S_4$.

"As a matter of fact I believe all these bodies are present in the liquor."

The liquor which we have left at the tank of No. 3 scrubber is next pumped to the top of No. 1, largely as polysulphide of ammonium, the mono-sulphide not being permanent. This meeting the foul gas in the presence of water accomplishes a sort of double decomposition, the CO_2 being of course a stronger acid than the H_2S; formula about as follows for the main reaction,

$$2(NH_4HS) + CO_2 + H_2O = (NH_4)_2CO_2 + 2H_2S,$$

forming ammonium carbonate to add to the composition of the liquor, and freeing H_2S to be extracted in the No. 2 scrubber, together with that originally contained in the gas. There is also a reaction of the $[NH_4]_2S_2$ on a cyanide supposed to exist in the crude gas as HCN or prussic acid, forming sulpho-cyanide of ammonium.

The gas purification is now completed. The liquor from the tank next No. 1 scrubber, consisting of ammonium carbonates, sulphides, and a little free ammonia (less here than at any other point in the process) is carried to the top of the carbonator, the first vessel of the ammonia recovery plant. Here it meets the gases H_2S and CO_2 from the heater, which follows—the main reaction being much the same as in No. 1 scrubber—that is, the CO_2 combines with the ammonium sulphide and frees yet more H_2S, which, with the excess of CO_2, passes to the catch tower. This vessel has clear water or spent liquor descending through it in order to combine with any free NH_3 which may have been driven off in the heater and have come from the carbonator with the other gases. Next, the H_2S and CO_2 pass to the Claus kilns, of which there are two of 7 feet and two of 5 feet diameter, arranged to be worked in any desired combination. A small blower forces a current of air equal to 2½ times the determined amount of H_2S in the inlet gases, into the upper division of a kiln. Chemical action ensues to raise the temperature, and the gases and air pass down through a tray covered 18 inches deep with oxide of iron, or spent pyrites, thence into the brick sulphur chamber, where, making their way between and against a number of alternate right and left baffle-walls, they deposit a nearly pure form of sulphur, thus: $H_2S + O = H_2O + S$. If an excess of air is forced in, SO_2 will be formed; and if the amount of air is insufficient H_2S will pass out uncombined, and the proper amount of air can be determined largely by the smell. But at the outlet of the chamber another catch is used, a small tower in which water trickles over lime stones for the detention of SO_2; and after this there is an open bed of iron oxide for the possible H_2S. The CO_2 and the nitrogen of the air are, of course, not offensive and escape freely.

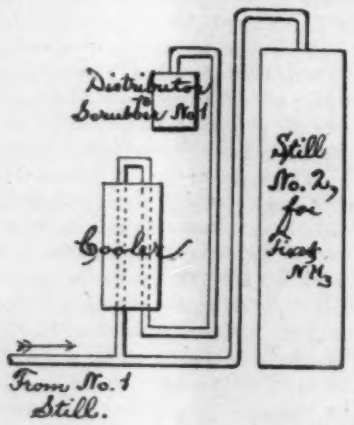
The liquor, whose course has been followed through the carbonator, goes from it to a tank which also serves to receive that from the catch tower, and then is pumped to the top of the heater. This apparatus consists of a number of trays one above another, alternately 4 in. and 2½ in. deep, and used for liquor and steam respectively. The liquor travels from side to side betwen baffles of angle iron in a depth of 2½ in. till it reaches the overflow at the corner farthest from its entrance, then passes to the next liquor tray below. The steam is admitted to each closed tray, and the hot water from its condensation runs immediately to a drain. The temperature should be 185° F. for the liquor on the top tray, and 195° F. for that near the botton, the object being to decompose the carbonate and sulphide of ammonium into CO_2, H_2S, and NH_3, then knowing the relative solubilities of those gases so to adjust the heat as to keep the NH_3 in solution while the other gases go to carbonator, catch tower, kilns, etc., as described. The liquor at the heater outlet is analyzed daily, and shows very clearly what care has been paid the heater temperature during the preceeding hours.

From the heater tank the liquor is pumped to the No. 1 still, a tower like the scrubbers, but of less diameter, and jacketed. Into the bottom of this naked steam is admitted, driving off the free NH_3 in gaseous form to the ammonia condensers, which are simply two multitubulars from which the ammonia condensed as strong liquor goes to the tank of No. 5 scrubber, while the NH_3 gas enters No. 2 scrubber, as previously described.

The spent liquor from the No. 1 or "free ammonia" still, which it has entered intensely alkaline, should s ightly redden litmus paper at the outlet owing to the presence of hydrosulphocyanic acid. It is pumped as already mentioned to the No. 5 scrubber; but as when running fully more spent liquor is produced than is necessary for this purpose the excess is pumped to the No. 2 or "fixed ammonia" still. An emulsion of cream of lime is, by a stea .1 injector, forced into this vessel from the mixer where prepared; and, with steam passing up and liquor descending through this still in the presence of this hydrated lime, the fixed salts of ammonia are decomposed and NH_3 driven together with any excess of steam to the larger or No. 1 still, thence to the ammonia condensers, etc. The products from the small still, calcium-sulphide, carbonate, and sulphocyanide, are worthless; but if it is desired to obtain a marketable sulphocyanide, soda could be used instead of lime in the No.

2 still, or the spent liquor from No. 1 still could be run to evaporating pans and the ammonia sulphocyanide obtained.

That portion of the liquor which is used in No. 5 scrubber is first passed through a cooler, that the proper temperature may be reached for the greatest absorptive action on NH_3. In order that a sufficient supply may reach No. 5 and yet none of the excess—which is to go to the No. 2 still—need be cooled, the following arrangement has been adopted. The distributor to each scrubber includes two of Cutler's "variable discharges," supplied through a valve set in accordance with the make, from a tank above the tower. The top of each scrubber consists of a 4 inch chamber in six sections, each section supplied by a 1 inch pipe from the siphon boxes, and with perforated plugs in the bottom giving spread streams by divergent holes. To prevent trouble in case both siphons should discharge at once, the circling pipe, which supplies the six sections, is divided by two valves. The liquor from the free still then travels as shown, that for the scrubber passing through the coole , and that which from the set siphon valve cannot enter there being forced higher and returning downward to the "fixed" still.



The heater is built in duplicate, and it is best to have the No. 1 still in duplicate also, though this was not done at Belfast. Any one of the first four scrubbers could be bye-passed in an emergency, and though No. 5 could not be dispensed with, the chances of its stopping up or requiring cleaning are slight.

If desired, sulphate of ammonium can be produced next the carbonator by the use of a saturator containing sulphuric acid, the gases from the carbonator bubbling through the acid in the closed portion of the saturator, and escaping as CO_2 and H_2S to the kiln as usual, while the salt slides down and is fished out at the lower division, open at top. The catch tower is provided with valved outlets at several points in its height. In the system as first described in this article the carbonator gases would enter at the bottom and leave through the topmost outlet; but in this manufacture of sulphate the *bottom outlet* is used ordinarily; however, if the liquid in the open portion of the saturator shows alkaline, the upper outlets can be opened and part of the ammonia washed out for return with the carbonator liquor to the heater.

After the Claus apparatus the gas was sent in three streams to sets of ordinary lime purifiers, but for some days previous to my visit there had been no action in the boxes, and a freshly moistened acetate of lead paper showed no stain in a minute's exposure at the first box, as the Claus apparatus completely cleaned the gas.

The advantages claimed for the Claus process are briefly: First, a less space required for purification than when scrubbers and lime or oxide dry purifiers are used. Second, avoidance of the nuisance arising from opening boxes, and of the loss of gas in the opened box and the admitted air when the fresh box is put in action. Third, adaptability to the Claus system of any apparatus in the nature of washers or scrubbers in present use, thus lessening the cost of installation. Fourth, recovery of the sulphur in a most marketable form, and recovery of the sulphocyanide, if desired.

Against these must be set the facts that although occupying less space the cost of the Claus vessels is at least as great as that of the apparatus they supersede, while the expense for steam about offsets the saving in labor and material for the dry purifiers. It is said that the steam from 25 gallons of water per ton of coal carbonized should be sufficient to work the pumps, and the exhaust from the pumps should work the stills, while 25 gallons more would be necessary for the heater.

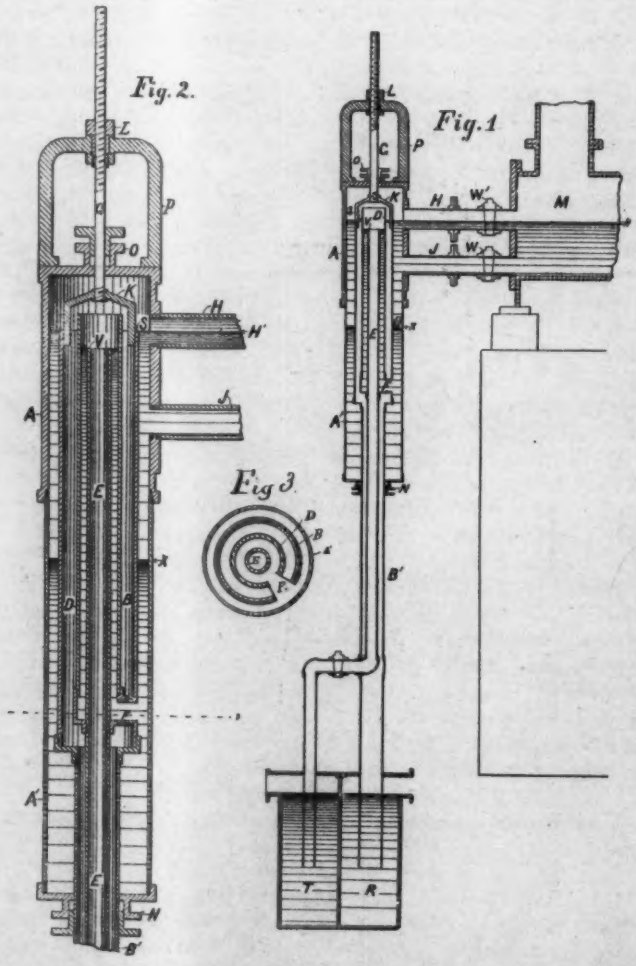
The sulphur recovery, however, is unquestionably profitable. This feature of the process is in use at a number of gas works where the gas purification portion of the Claus is not employed; for instance, at Old Kent Road (South Metropolitan Company, London), Crystal Palace District Company, at the Stafford and the Leicester Corporation works, etc. The prevailing practice in this adaptation of the system is to wash the gas with ammoniacal liquor of 8-ounce or 10-ounce strength in Livesey or tower washers, the liquor then being distilled, and the NH_3, H_2S, and CO_2 driven off to a washer which retains the ammonia in solution to be again used in washing or for working up, while the other gases pass to to the Claus kiln as already described. The catch tower for SO_2 and the oxide for H_2S are also found necessary in spite of the greatest precaution, the latter seeming to recombine near the outlet after dissociation further ahead in the apparatus. This method, of course, materially lightens the work of the purifiers, and with it the number of boxes on a stream of gas might be lessened after experiment.

Hyde's Patent Overflow-Gate and Liquid-Separator.

On May 27, U. S. Letters Patent (No. 428,613) were granted to Mr. Gustavus A. Hyde, Jr., of East Saginaw, Mich., for an apparatus destined for use as a combined overflow-gate and liquid-separator for liquids of varying specific gravities. Mr. Hyde, in the specification on file in the Patent Office, says that the invention relates to devices for the removal of liquids from apparatus commonly in use in the manufacture and purification of gas, and has for its objects, first, the adjustment of the levels of liquids contained in such apparatus, and, secondly, the removal of either the heavier or the lighter liquid as fast as deposited without deranging the surface level of the other lighter or heavier liquid.

He then proceeds to specify its details, reference being made to the accompanying drawings, in which similar letters designate like parts in all the figures. Fig. 1 shows a vertical section as attached to the hydraulic main commonly in use in gas works; Fig. 2 shows an enlarged section view; and Fig. 3 is a horizontal section through the device on line 3 3, Fig. 2.

A A' is a cistern to receive the lighter liquid and tar through the conducting pipes *H* at the surface level of the lighter liquid and *J* at the bottom of the hydraulic main *M*, the tar, from its greater specific gravity, settling to the bottom of the cistern.



It is requisite to the working of the invention that the gas pressure

from the main *M* be admitted to the upper part of the cistern *A A'*, either through the pipe *H*, as shown, or through a pipe especially provided for the purpose.

Within the cistern *A A'*, and adjustable vertically therein and passing through the packing box *N* in the bottom of the cistern *A A'*, as shown, is a system of vertical tubes *B*, *B'*, *D*, and *E*, arranged concentrically one within the other, so as to form annular cylindrical spaces, which, with the unions *E'* and *F'* and connecting tube *F*, constitute the gate and separator, to be described hereinafter, the same being adjustable vertically by means of the bail *K*, threaded gate stem *G*, nut *L*, and brace *P*. The gate stem *G* is provided with packing box *O* on the cistern *A A'*, substantially as shown, and for the purpose of making a gas-tight joint.

The gate is so constructed that the tube *B* determines the level of the lighter liquid only, all surplus liquid above its upper edge *S* falling over the edge *S* and descending by gravity between the tubes *B* and *D* to the tube *B'*, thence to the dip seal box *R*, and escaping.

Within the gate tube *B*, and connected thereto near its base by means of the tube *F* and joint *E*, is the concentrically located tube *D*, terminating at a higher level than the gate tube *B*, and forming a secondary cistern having an open way through the tube *F* to the contents of the cistern *A A'*, as shown, so that the contents of the cistern *A A'* have free access to the cistern within the tube *D*. Concentrically located within the tube *D*, and continuing downward through the bottom of the same, and within the tube *B'* and out of the tube *B'*, to the dip seal box *T*, substantially as shown, is the overflow tube *E*, rigidly fixed relative to the above-mentioned system of tubes *B B' D E F*, and thus adjustable vertically and simultaneously with the system of tubes *B*, *B'*, *D*, *E* and *F* through the means of the above-mentioned adjusting device *K*, *G*, *L*, and *P*.

In describing the action and operation of the invention, Mr. Hyde says:

Having first filled the cistern *A'* with tar to a point considerably above the level of the tube *F*, which procedure is required but once, and having adjusted the system of tubes forming the combined overflow gate and separator *B B' D E F* through the means of the adjusting mechanism, as before described, so that the edge *S* of the gate tube *B* is at the level *H'* required of liquid in the hydraulic main *M*, the cocks *W* and *W'* of the conducting tubes *J* and *H*, respectively, are opened, thus allowing the liquids in main *M* to flow into the separator, as before described. Owing to the greater specific gravity of the tar deposited, as before mentioned, in the main *M*, the tar as soon as deposited flows out of the main *M* through the conducting pipe *J* and settles in the cistern *A A'*, and by displacement through the tube *F* to interior of tube *D*. Because of the overflow tube *E* terminating at a lower elevation *V* than the gate tube *B* at *S*, and the cistern *D* being filled with tar of greater specific gravity than the lighter liquid in the upper part of the cistern *A A'*, a balance of the two liquids is maintained, whereby the shorter column of denser liquid or tar in cistern *D* equals in pressure the longer column containing in part the lighter liquid in cistern *A A'*, and the division between the two liquids will be at same level, as *X*, between tube *F* and pipe *J* in the cistern *A A'*, as shown in Fig. 2.

It is obvious from the foregoing description that as rapidly as the tar flows into and settles in the cistern *A A'* a like amount of tar is displaced and flows downward and within the tube *E* to dip seal box *T*, and that as the lighter liquid flows into cistern *A A'* in like ratio does it flow down and within the tubes *B* and *B'* to dip seal box *R*. Thus the invention maintains constantly a certain level of the lighter liquid, removing all surplus as formed and deposited, and also separates and removes therefrom the tar as rapidly as it is in like manner deposited.

The cistern tube *D* terminates at a higher level than the gate tube *B*, in order to prevent any of the lighter liquid from getting into cistern *D* while in its passage down and within gate tube *B*, thereby preventing any derangement of the liquid balance hereinbefore referred to and contaminating the otherwise pure tar separated.

Competition in Gas Supply and the Invariable Result.

By Mr. Frederic Egner.

Cause and effect are closely related, and like causes, operating under similar conditions, produce corresponding results. This is true of all things, including, of course, competition in the gas supply of cities, towns and villages. Briefly stated, competition in gas supply will result in just two things, viz.: Greater cost of the gas to the consumer in the end, and making cheap gas less and less possible, according to the extent that competition is indulged in. This can be shown by quoting the ultimate results of competition in gas supply in a number of American cities. At first, indeed, the price of gas would be lowered by competing companies, but in the end consolidation would take place, and an increase in the selling price of gas would follow as a rational sequence, because, whereas, formerly interest or dividends would have to be earned only upon the capital of the original company, now the same would have to be done for the additional capital invested by the opposition company; for capital will seldom permit itself to be annihilated. The reductions in the selling price of gas, which may occur to the consumer, and which in his opinion were directly caused by competition, are in reality due to the improvements made in process and apparatus for the manufacture of gas within the past 20 years, and in *no wise to competition*. On the contrary, had there never been any competition, gas would now in most instances, be sold at lower rates than was ever asked for by discontented consumers or legislative bodies in this country. There would, perhaps, be rare exceptions to the above rule; but such, if there were any, could be dealt with by wise legislation, such as the Commonwealth of Massachusetts has inaugurated in establishing a Board of Gas and Electric Light Commissioners—one of the best means for protecting the interests of invested capital and users of gas or electricity for light, heat and power that could have been devised, as the experience of some years of work by said Commission has demonstrated to the entire satisfaction of the people and the companies. A reason why (which must appeal to the common sense of the consumer) competition is sure to cause an increase in the selling price of gas has been given; and now a few examples to prove that assertion will be related. In the city of New York proper there are now four gas companies; the streets are filled with duplicate, and, in some streets, even quadruplicated sets of gas mains, and gas is sold by legislative enactment at $1.25 per 1,000 cubic feet. Labor is much cheaper at New York than at St. Louis, for instance; and in the former city they have seven to ten times as many consumers per mile of main in New York than we have, and yet here gas is sold at $1.18 per 1,000 cubic feet, with the prospect good for an early material reduction, if the local gas company is let alone and given a fair chance to show what it can or will do. At Baltimore they had one gas company in 1872, which gave fair satisfaction. But first, one then another, and still another, applied for and obtained charters to tear up the streets and sell gas. All made great promises as to selling price of gas, and all the usual safeguards to prevent consolidations were taken. And so they had competition, and, for a few months, very cheap gas.

Then, despite all provisions of the charters, and all promises made by the competing companies, all consolidated, and to-day Baltimore is paying much more for gas than St. Louis, although the material necessary for gas making can be had at the former city at about one-half of the price, and even less, than the St. Louis Gas Company has to pay. Baltimore had competition, New Orleans the same, Brooklyn, N. Y., Poughkeepsie, N. Y., and dozens of others had it, with the same result as at Baltimore, viz., higher price of gas, paying dividends on two or three gas plants when one was plenty large enough to fully supply the demand.

Would it not be better to have the gas plants managed by the municipal authorities? Certainly not; for if the honest inquirer will turn to the history of the Philadelphia Gas Trust, he will hardly advocate municipal control of gas works. At Wheeling, W. Va., gas is sold at 90 cents per 1,000 cubic feet, and there the gas works are managed by the city authorities; but Wheeling is located in the heart of the best gas coal country in the world; natural gas and petroleum abound, and there is not any doubt in the mind of any educated gas man but what gas could be sold at 60 cents per 1,000 cubic feet at Wheeling if the works were managed by private business men, instead of the municipal corporation. At Cincinnati, O., they have but one Gas Company, and as a consequence, gas can be, and is, sold cheaply; the employees are paid good wages; the securities of the Gas Company are valued as a secure investment, and everybody is happy. No; encouraging competition is not the best way to obtain cheap gas, except, as I remarked, in the beginning, in rare cases. There may be such when a gas company refuses to improve its plant and continue onward with the rest of the world in the march of improvement; or it may be involved in other ways, making cheap gas next to impossible.

Before encouraging competition, let the people inquire if, after all, their own home company is not doing all that can be reasonably expected. Let them remember the results of competition as herein stated, which statements are the exact facts in the cases quoted. Let them remember all this before recklessly destroying that which in some—in many—instances represents the living of dependent families, who have trustingly merged their little capital with the larger one of the home gas company, and who, as a part of the local community, deserve undoubtedly more consideration at the hands of the people—their own

neighbors, perhaps—than the strangers who come with great promises and in the hope of catching your dollars. In the latter they too frequently succeed (all the people's fault, however), while the promises, like most promises made by that kind of philanthopists, are invariably broken, and which, from the very nature of things, cannot be kept.

[A Paper read before the Society of Arts, England.]

The Mannesmann Process for Making Seamless Tubes.

By J. G. Gordon.

A great philosopher has said that the consumption of soap in a country is the measure of the degree of civilization attained by its inhabitants.

When we consider that the ever-increasing variety of uses to which tubes and pipes are now put, it seems to me that it would be equally true to say that the quantity of tubes manufactured and used in any given country serve as a good measure of that country's progress in civilization.

For the conveyance of water, gas, oil, and steam, for warming and ventilating dwellings and other buildings, and in the construction of all sorts of engines and boilers, as well as for the transmission of power by means of water or air, and last, but not least, for the construction of all sorts of fire-arms, from the 110-ton gun to Colt's deringer, tubes are indispensable; while at the same time engineers are turning more and more attention to tubular form for many parts of structures as they preeminently combine lightness with strength.

Before the beginning of this century the use of tubes was comparatively small. Apart from conduits for water, which were generally made of tree trunks with a hole bored through them (as some recently dug up in Harley steeet show) when they were made in the form of pipes at all, the main use of tubes, or more strictly speaking, of metallic tubes, was for firearms.

It appears that cast iron pipes were first cast about the year 1780, I believe at Coalbrookdale Iron Works, and the manufacture has gone on increasing ever since; the consumption of this kind of tube in the United Kingdom alone must be something enormous, considering that there is no town or village where gas and waterworks exist that has not at least two lines of such pipes lying below every street.

Murdock's great invention, illuminating gas, seems to have given the first impulse towards the manufacture of wrought iron tubes on a large scale, as they are necessary for the distribution of the gas from the mains to the houses, etc.

At first, rejected gun barrels, connected together by ferrules, were used for this purpose, but the manufacturers soon devoted their attention to supplying tubes in longer lengths, and from about the year 1808, when Benjamin Cooke took out a patent, more and more attention has been devoted to the perfecting of the machinery for their manufacture, and the materials of which they are made.

The process of manufacture of welded wrought iron and steel tubes consists first in making a strip of metal of the length of the tube required, and rather wider than the circumference of the tube required. This strip of metal is heated to a welding heat, and then bent by machinery into a tubular form. It is then welded either by means of hammers, by drawing through a die, or by being passed between rolls of appropriate section, and much skill and ingenuity have been devoted to perfecting all the details of this complicated and difficult process, with the result that now such wrought iron or steel tubes can be obtained in almost any quantities, and at prices which, compared to those which were formerly paid, are very moderate. But although the wrought iron and steel welded tubes are both cheap and good, they had, and still have, a weak point—namely, the weld. It is here that they are generally found to give way under any severe strain, besides which, above and below certain diameters—that is, below 1 inch and above 6 or 7 inches—the difficulties of the manufacture of welded tubes are much increased. This difficulty in making tubes of larger diameter has been overcome, to some extent by rivetting together plates bent into tubular form, but this is necessarily a costly process, and considerable difficulty is experienced in making the rivetted joints perfectly tight. It has therefore been the aim of many inventors for the last 30 or 40 years to produce weldless or seamless steel and iron tubes, and a considerable number of processes for producing such tubes have been devised, and many patented in this and other countries, by means of some of which at the present time considerable quantities of weldless tubes of high quality are being produced. The Mannesmann process, the subject of the paper I have the honor of bringing before you this evening, is one of these latter processes. It has already been described in a paper by Mr. F. Siemens, read before the British Association at their Bath meeting in 1888, in which that gentleman pointed out the salient features of the new process.

The Messrs. Mannesmann produce weldless or seamless tubes of steel, or any other ductile metal, such as copper, bronze, delta metal, lead, or aluminium, by rolling them in skew-rolls; that is to say, in rolls which are not parallel either to one another, or to the bar or other material to be treated by them. Perhaps the photographs will make this clearer than any verbal explanation.

Here a photograph of ordinary rolls parallel to each other was shown, and then a photograph of Mannesmann rolls.

It will be seen that, in the ordinary rolls, the bar to be rolled is put in at right angles to the rolls, which revolve in opposite directions. But in the Mannesmann tube-mill both rolls revolve in the same direction, and the bar to be acted upon is placed between them lengthways, while, as before mentioned, the axes of the rolls are not parallel to one another. In the photograph on the screen, these are the rolls, and the tube in front of them acts as a guide for the bar, which is pushed in between them.

These rolls revolve at about 200 to 300 revolutions per minute, and by their action on the hot, and therefore plastic steel, stretch it, and make a hollow in the center.

To explain why the rolls acting in this peculiar manner have the effect on the bar of steel subjected to their action of converting it into a tube, I cannot do better than to quote from the paper by Mr. Frederick Siemens already alluded to. He says:

"To obtain a simple forward spiral action of the bar, the length of the rolls is immaterial; it will take place when the rolls are reduced to the form of thin discs. Supposing the discs to be infinitely thin, or what is the same thing, that their outer edges are reduced to a mathematical line and no sliding motion takes place, the bar must still move forward spirally, its spiral velocity being equal to the velocity of the outer circumference of the discs. If, instead of one pair of such thin discs, several pairs of discs of regularly increasing diameters are made to revolve on the same axis, the outer circumference of each disc will revolve with greater velocity than that of the preceding one. The same bar is, however, drawn forward through the several pairs of discs, and thus as each part of the bar enters successively a more advanced pair of discs, the velocity with which that portion of the bar rotates increases, and it is drawn forward by each succeeding pair of discs as they catch hold of it with ever-increasing speed.

"It will be understood that a bar passing through such a series of discs, no slipping being possible, the material of which it is composed cannot retain its original area or volume. The diameter of the bar being regulated by the discs, while simultaneously a violent stretching action is carried on, the material required can only be drawn from the inside of the bar, and thus a hollow space is formed.

"Instead of this peculiar arrangement of discs a conical, or rather conoidal, pair of rolls, which amount to the same thing as the discs, considered as joined together, may be provided. It follows that a bar or rod of suitable dimension which is passed through the Mannesmann rolls will, provided its substance is sufficiently homogeneous and plastic, undergo a violent twisting and stretching action, the fibre being spun as is the fibre in a rope, on account of which the process may appropriately be called a tortional process. The bar in its passage through the rolls is twisted as a thread is twisted in a spinning machine. As, however, it cannot be fed from the outside as is the thread, and, as has been said, the diameter cannot be reduced on account of the action of the rolls, it is forced to draw on the interior for a supply of material.

"I will attempt to explain in another way.

"The tube is made thus. A bar is placed between the conoidal rolls at the part where their diameter being least the speed at which they move to make a revolution is also least. The rolls seize the bar and draw it into contact with parts of the cones which move more and more rapidly, though, owing to the way in which the rolls are set, the space left between them for the passage of the bar decreases slightly. Slight, however, as is this decrease in the space between the rolls, a certain amount of material has to be shifted. The action of the rolls prevents this material from being taken from the outside of the bar, and consequently it is drawn from the interior—hence the tube. Soon after entering the rolls a small central fracture is formed, which widens out to a hollow space as the increased stretch is made to take effect in an increased twist acted on from the surface.

"The increasing twist of the fibre of the bar while passing through the rolls, and the peculiar relation kept up between longitudinal and turning action, is the characteristic of the Mannesmann tube-rolling machine, and this action it is that enables it to make a tube from a solid bar or ingot.

"Though the bar is thus converted into a tube by the action of the rolls, and their action only, a mandril is generally used to finish and

smooth the interior and enlarge the tube. This use of the mandril has led to the erroneous belief that it is necessary to form the hole in the bar. No machine, however, could stand the strain if it were attempted to force a mandril longitudinally through a solid bar of hot steel. Such an operation is impossible. Just sufficient power is used to form the hollow in the bar from the action of the rolls on the outside, and into this hollow the mandril enters, smoothes the inside, and, when required, enlarges the tube. Thus we have the strange experience in rolling that by one operation the bar is made hollow and also longer and wider than when it entered the rolls a few seconds before."

Here is a tube, or rather a hollow bar, manufactured by the Mannesmann process, which shows that the mandril mentioned by Mr. Siemens takes no part in the process of making the hole, or in other words, converting the solid round bar into a tube.

Before being passed through the Mannesmann rolls the ends of this bar were slightly drawn down under the hammer, so that for about an inch and a half at both ends its diameter was decreased so that the rolls could not act on them. After being passed through the rolls the bar was broken in the middle, and, as you see, a tube had been formed from the solid bar along all that part of its length on which the rolls acted, while both ends remained solid. A hollow produced thus in a massive steel bar should be a perfect vacuum. In order to test this, Messrs. Mannesmann sent several such tubes with closed ends to Professor Finke, in Berlin, who devised a most ingenious apparatus for testing both the pressure in the interior of the tube, and also the chemical composition of the gases, if any, contained therein. As the average result of several experiments he found that the pressure in the tube was as nearly as possible one-tenth of an atmosphere, and that the gas which the hollow did contain consisted of 99 per cent. of hydrogen, and he considered it most probable that the other 1 per cent. was nitrogen.

Here are some photographs taken at the Mannesmann Tube Company's works. This is a photograph of the largest Mannesmann mill as yet erected, and which has produced all the large tubes you see before you.

This is the mill, these are the steam engines, and here is the large fly-wheel, this is a very valuable aid in the process. The power required to produce the tubes is very large, something like from 2,000 to 10,000-horse power, according to the dimensions of the tube. If a steam engine of this power had to be provided for each machine, the plant would of course become extremely costly, but, luckily, this great power is only required for a short time; for each tube made 30 to 45 seconds suffice to convert a bar 10 to 12 feet long, and 4 inches in diameter, into a tube, and then some time elapses while the next bar is brought up, adjusted in the guides and the finished tube is removed. During this time it is possible to accumulate energy in the fly-wheel, and by this means a comparatively small steam engine of about 1,200-horse power is quite sufficient to do the work.

The fly-wheel differs materially in construction from those ordinarily in use, and was designed by Messrs. Mannesmann to guard against the terrible danger of bursting, to which accident cast iron fly-wheels are only too subject when worked at high speed. This wheel consists of a cast iron hub, to which are securely bolted two discs of steel plates of about 20 feet in diameter; around the periphery of the wheel thus formed about 70 tons of No. 5 gauge wire are wound under a tension of about 50 lbs., thus binding the whole securely together. There can be no comparison between the resistance of a wheel so constructed to the centrifugal force than that offered to this force by a cast iron one. This fly-wheel of 20 feet in diameter and weighing 70 tons, revolves 240 times per minute; therefore, the periphery of the wheel has a speed of 2.85 miles per minute, or nearly three times the speed of the "Flying Dutchman." This fly-wheel works on the main shaft from which the tube mill is driven by means of helical-toothed steel wheels.

Behind the steam engine are the doors of the heating furnace—it is a Siemens regenerative furnace, heated by radiation—the only thing which distinguishes it being its great size; it is 33 feet long by 21 feet wide, and has an area of 789 square feet.

The small steam engine near the rolls is used for adjusting them.

It is one of the many distinctive features of the Mannesmann process that much greater accuracy is required in the adjustment of the rolls than was hiterto dreamed of in the philosophy of iron and steel millwrights. Hitherto, even such delicate work as rolling fine wire rods, and thin sheets for tinning and stamping, has been accomplished by machinery, comparatively speaking, of the roughest description, in which the skill of the rollerman and roll turner had to make up for the inaccurate fitting and adjustment of the rolls. But in the Mannesmann mills every part is as carefully and accurately fitted as in a locomotive or marine engine, and the screws and balances are designed to, and do, enable the foreman roller to adjust the rolls to the $\frac{1}{32}$ of an inch.

The photograph now on the screen is a smaller Mannesmann tube mill already shown when describing the process; there are here two smaller wire fly-wheels, one to each of the rolls.

After the tubes have been rolled, it is generally necessary to cut screws on the ends, as this is the usual way of connecting steel and wrought iron tubes together, for making them into gas or water mains and other similar purposes.

Here is a photograph of the screwing machines at Landore; there are twelve of them; they are made to cut screws on tubes of any diameter, from 2 inches up to 12 inches. The screws cut by these machines are known as the American tapered thread screws. To make these the machines, instead of cutting the screws to a uniform depth, begin by making a deep cut which slightly dimishes with every turn, so that the end of the tube becomes slightly conical This is an improvement on the ordinary straight thread, as every turn makes the socket fit tighter on to the tube, while when it is wanted to unscrew the tube it is more easily released.

Here is a pile of tubes finished and ready for inspection.

The three next slides are photographs of the tubes which have been tested under compression, and which are here before you.

These tables give the results. The first and second series are Mannesmann tubes, the third are lap-welded wrought iron tubes, which have been tested by way of comparison.

TABLE I.—*Steel Tubes.*

External diameter of the tubes before turning.... 4½ in.
Length over all..... 1 ft. 5½ in.
Length between shoulders..... 10 in.

	External Diameter.	Internal Diameter.	Thickness.	Area.	Ultimate strength per sq. inch.
A	4.45 inches.	4.36 inches.	.045 inches.	.622 sq. in.	20.9 tons.
B	4.47 "	4.33 "	.07 "	.939 "	25.53 "
C	4.5 "	4.31 "	.095 "	1.315 "	27.7 "
D	4.561 "	4.325 "	.12 "	1.666 "	—*

*The testing machine was not strong enough to have any effect on tube D.

A strip cut parallel to the axis of a tube, similar to those used in the above tests, gave the following results when tested:

Breaking strain per square inch, 35 tons; elongation in 8 inches, 25 per cent.; contraction of area, 54.2 per cent.

TABLE II.—*Steel Tubes.*

External diameter before turning..... 3½ in.
Lengths over all..... 1 ft. 5½ in.
Length betwen shoulders..... 10 in.

	External diameter.	Internal diameter.	Thickness.	Area.	Ultimate strength per sq. inch.
A	3.31 inches.	3.2 inches.	.055 inches.	.600 sq. in.	18.6 tons.
B* ...	3.3 "	3.18 "	.06 "	.611 "	25.3 "
C* ...	3.36 "	3.19 "	.085 "	.871 "	28. "
D* ...	3.29 "	3.03 "	.13 "	1.10 "	34.9 "

* B, C, and D of this set failed without fracture.

A strip cut parallel to the axis of a tube, similar to those used in the above tests, gave the following results when tested in tension:

Breaking strain per sq. in., 37 tons; elongation 20 per cent. in 8 ins.; contraction of area 42.5 per cent.

TABLE III.—*Wrought Iron Tubes.*

External diameter of tubes before turning.. 3⅞ in.
Length over all..... 1 ft. 5½ in.
Length between shoulders..... 10 in.

	External diameter.	Internal diameter.	Thickness.	Area.	Ultimate strength per sq. inch.
A	3.63 inches.	3.55 inches.	.035 inches.	.399 sq. in.	17.54 tons.
B	3.7 "	3.56 "	.07 "	.802 "	18.08 "
C	3.73 "	3.53 "	.10 "	1.14 "	10.98 "
D	3.78 "	3.54 "	.12 "	1.38 "	20.9 "

Of course it requires a larger series of tests than these to be able to deduce many definite conclusions from them, but they go to show that under compression these tubes stand better than the welded ones, and that when they give way they do not break, but only bend. These large specimens are too heavy to be handed round, but there are some smaller ones which show that even when the tubes are completely crumpled up they will not burst or crack.

These tests under compression were made to show the value of the Mannesmann tubes for use in all sorts of engineering construction, and the results are satisfactory as far as they go. At the company's works there are at present no means for testing long lengths of tubes under compression, but the company hope soon to have such tests made for them.

What mainly distinguishes the tubes made by the Mannesmann pro-

cess from all weldless tubes hitherto made is, first, that they are made from bars of solid steel or other metal into tubes without any preliminary boring of the material; and, secondly, that the fibre of the metal runs spirally round the tube when made.

In all other processes for making weldless or seamless tubes the material is either cast in the form of a cylindrical ingot with a hole down its center, or the metal, after having been cast, forged or rolled into the form of a cylinder, has a hole bored through its centre. The hollow cylinder, whether cast or bored, is then drawn through a series of gradually diminishing dies, and over an appropriately shaped mandril, on a draw-bench similar to those employed in wire drawing. This, of course, necessitates frequent annealing of the material, as otherwise it would soon become brittle.

These successive drawings tend to produce a longitudinal fibre in the metal, just as the ordinary rolling of iron and steel bars and strips does, and such a longitudinal fibre necessarily tends to make the tube weaker, especially as regards internal pressure, than the Mannesmann tubes with a spiral fibre, the quality of the metal and all other conditions being the same in both tubes.

That a spiral fibre has long been regarded as a source of strength is shown by the method adopted by gunsmiths for making shot guns of good quality. As is well known, these are made by welding together the best quality of scrap iron, such as horseshoe nailes. These are carefully made into small rectangular rods, which are then coiled round a mandril and welded together, and thus forming a spiral fibre. A collection showing this process in all its stages, from the packet of scrap iron to the finished gun barrel, is exhibited in the Museum of Practical Geology, Jermyn street. On a large scale this process is used by Lord Armstrong for making the wrought iron coils for his celebrated guns.

For purposes of comparison I have here two small bottles made out of a Mannesmann tube and a lap-welded boiler tube respectively. These have been filled with boiled water, and placed in a freezing mixture. The expansion which takes place on the solidification of water to ice exerted sufficient force to burst the lap welded tube, but you see that the Mannesmann tube withstands this great pressure. Here are a pair of similar tubes; the one with the white paint on it is the Mannesmann tube. You will see that the welded tube has split in the direction of the longitudinal fibre from end to end. This small tube has also withstood a severe test. It is an inch in internal diameter, and about $\frac{3}{64}$ of an inch in thickness. This was subjected to an internal pressure of 3 tons 15 cwts. to the square inch, at Messrs, Siemens Bros. works at Charlton, when the leather washer closing one of the ends gave way. When taken out the tube was distinctly warm to the touch, but otherwise exactly the same as before the test was applied. This pressure of 3 tons 15 cwts. per square inch is equal to a tensile strain on the metal of over 70 tons per square inch.

The power of resisting great internal pressure makes the tubes particularly well adapted for vessels made to contain gases at high pressures, such as oxygen and carbonic acid, which are now being largely used in the arts, and it may also serve to extend the use of compressed air, a subject to which our Chairman has devoted much attention.

Unfortunately, the tube testing machines have only just been delivered at the Landore works of the Mannesmann Tube Company, so that no other tubes which have been tested to very high pressures can be put before you, but at the Austrian Mannesmann Works, at Komotau, more than 600 tons, or 25 miles of 4-inch and 3-inch tubes, about ¼-inch thick, have been tested to a pressure of 2,000 pounds per square inch, and passed by Mr. E. Woods, inspector. These tubes have been sent to Chili; they are intended for a high pressure water main for pumping water up to the rainless nitrate deposits.

But the severest test which the Mannesmann tube can possibly be subjected to is the process of manufacture itself. If the metal is homogeneous throughout, and well melted, well rolled, and carefully heated, it makes, as you see, a perfect tube, or at any rate, a near approach to it; but if there is any flaw in the bar, or if the furnace man has been careless in the heating, then the Mannesmann rolls reject that bar, by refusing to make a tube of it, more sternly than the severest human inspector would. This process is, in fact, so far as regards what is called humoring the metal, to the ordinary rolling process, what the tilt-hammer is to the late Mr. Nasmyth's steam hammer, so that every tube made by this process comes into the world ready tested.

These are specimens of the tubes subjected to various tests, both hot and cold and of various dimensions; most of them are too heavy to be handed round, so as some of the audience may perhaps wish to inspect them more closely, the Society of Arts have kindly allowed them to remain on view in the library down stairs until next Tuesday.

As to the uses to which the tubes can be put, they can be used for all purposes for which tubes are now used; for water pipes, especially where water has to be carried long distances at high pressure, they are already being largely applied.

Table IV. shows the comparative weights per foot and per mile of cast iron pipes and Mannesmann tubes. It is obvious that wherever such pipes have to be transported long distances from the place of manufacture to the place where they are to be used, what a great advantage the saving in the weight to be carried will be, more especially in cases, like in South Africa and Australia, where railway transport is not often available.

TABLE IV.

Cas Iron Pipes.			Steel Tubes.		
Internal Diameter.	Weight per Foot.	Weight per Miles.	Internal Diameter.	Weight per Foot.	Weight per Miles.
3	13.5	31.8	3	6.2	14.6
4	18.6	43.8	4	8.2	19.3
5	24 5	58.4	5	10.1	23 8
6	31.1	73.3	6	12.1	28.5
7	37 3	87.9	7	14.1	33 2
8	45 0	106 0	8	16.0	37.7
9	52.9	124.7	9	18.0	42 4
10	62 0	146.1	10	20 0	47.1
12	74.5	175 6	12	25 0	58 6
18	140.0	330.0	18	46.8	110.1

Further, their lightness and the greater lengths to which they can be made, will effect a large saving in the cost of labor in laying them down and in the cost of the joints, both of which form a serious item in the cost of any pipe line. What has been said of water applies equally to petroleum and to gas and steam.

Another advantage of the Mannesmann tubes, for the purposes alluded to, is that they are capable of resisting much higher internal pressure in comparison to the thickness of their shells, or, in other words, of their weight per foot. While cast iron pipes will hardly stand more than 200 pounds per square inch, and welded tubes are not, as a rule, safe above 1,000 pounds per square inch, the Mannesmann easily withstands 2,000 pounds per square inch.

The length to which these tubes can be easily made is shown by this coil made of a tube 3 inches in internal diameter, and about ⅛-inch thick, by 70 feet long; it weighs about 6½ cwt.

Hollow axles for railway and other wagons, especially for field gun carriages and ammunition and other wagons, hollow shafts and poles for carriages, can be readily made from these tubes, as well as gun barrels and gun tubes and shells. The Prussian Government have already given the Mannesmann works large orders for military stores of various kinds, or rather, for the tubes from which to make them; for instance, the lances with which the whole of the German cavalry are about to be armed are to be made of Mannesmann tubes, and are already in course of manufacture. Three of them are among this group of Mannesmann tubes recently shown at Berlin, when Prof. Reuleaux read a paper on the subject of the tubes before the Berlin Society of Engineers, which will doubtless be published ere long. The German daily papers of all shades of opinion have already published long notices of this paper, not only because of Prof. Reuleaux's great reputation, but more especially because they are justly proud that the world should be indebted to Germany for such an important invention, which will no doubt in the future be reckoned among those decided steps in advance which the arts, which it is the aim of this Society to cultivate and encourage, make from time to time.

Messrs. Reinhard and Max Mannesmann, the inventors of the process, are the sons of Mr. Reinhard Mannesmann, file and steel manufacturer in Remscheid, which has for centuries been, in conjunction with the neighboring town of Solingen, what Sheffield and Birmingham are to England.

More than 30 years ago Mr. Mannesmann, senior, tried to manufacture steel rifle barrels by rolling down carefully-cast hollow steel ingots, but did not succeed in getting sufficiently uniform results to proceed further than the experimental stage; but he never quite gave up the idea, and when his two eldest sons left the university he told them of his experiments. They took them up and brought the training which they got at German universities, as well as their own indomitable perseverance, energy and determination, to bear on this problem, and have, after years of hard work, succeeded in constructing the machines and devising the process, the results of which you see before you.

At present there are five works making, or about to make, tubes by this process.

First, the parent works at Remscheid in Rhenish Prussia, where all the early experiments were carried out; then another works in South Germany, at Bous, near Saarbrucken; the Austrian works at Komotau;

a works near Duisburg, which is being specially erected for making tubes of copper and its alloys; and lastly, the works at Landore, near Swansea, belonging to the Mannesmann Tube Company, who have acquired Messrs Mannesmann's English patent rights. At these works, which are under the management of Mr. Charles Mannesmann, a brother of the inventors, three Mannesmann mills are now at work, and two more are in course of erection, so that the works will soon be in a position to turn out large quantities of seamless steel tubes of all sizes from 1 inch up to 16 inches in diameter, various specimens of which you see before you.

In conclusion, I wish to say that I am indebted to Mr. Charles Mannesmann and Mr. Pfau, the Chief Engineer at Landore, for the trouble they have taken in making the beautiful collection of samples I have had the honor of showing you this evening, and also to thank Mr. Mostyn Clarke, who has prepared all the slides shown this evening from photographs taken by himself, and who has carried out the greater part of the tests submitted to you at the test-house at Landore, of which he has the superintendence.

Discussion.

The Chairman said the subject was no doubt an important one. He did not know whether they would go to the length of saying that civilization was to be gauged by the feet run of tubes used in 12 months, but, nevertheless, the quantity used was a fair indication of enterprise and industry. Latterly a good deal had been done to supersede tubes altogether, by using wires as a means of conveying energy in the form of electricity, but water must still be sent through tubes, and any process which tended to produce the article more cheaply or better was one well worthy the attention of the Society of Arts. In 1888 he had the pleasure of hearing Mr. Frederick Siemen's paper at Bath on the subject, and it then occurred to him that probably this was about as extraordinary a method of arriving at the desired product as could well be imagined. The result of putting a solid circular bar of steel in between a pair of skew rolls was to cause it to change itself into a tube. This seemed to be very extraordinary, and although one knew it was done, he found great diffiulty in bringing home to his mind how it was done, and he had, almost in vain, endeavored to put it before himself in an intelligible way. The only way in which he could explain the result was somewhat as follows: Supposing he had a solid circular stick of putty, and he held that putty in his left hand at one end, and he took his right hand and drew the putty endways, if he held the putty pretty firmly the probability was that he would succeed in drawing out a sort of skin, which would come beyond the end of the solid putty, and so leave a cavity. One might have hold of a material, letting it go only gradually, while causing the outside to go forward at a greater pace, and in that way, by perpetually drawing forward the outward coating, you might succeed in converting a solid bar into a tube. He should have thought it would have been a most hopeless problem for any man to set himself to make seamless tubes in that manner, and it was difficult to imagine how the process was arrived at originally. Mr. Gordon had spoken of the great strength of the tubes, owing to the fiber being in a spiral direction, as in gun barrels, but it struck him that the metal must be subjected to enormous torsion, though the result appeared to be a satisfactory tube. The most striking specimen, and one which made it clear that no perforation by a mandril was needed, was the tube that was made out of a solid bar of which the two ends were somewhat reduced, so that the rolls did not operate upon them, and, therefore, there was formed in the bar itself a concealed tube with closed ends. That appeared to be an extraordinary illustration of the working of the process. It was obvious to his mind that one could succeed in making a tube which for such purposes as the storage of gases was absolutely faultless, as there was no joint in it from beginning to end. He thought they ought to be glad that the manufac ture had been established on so large a scale, and one could only wish it every success.

Mr. A. B. W. Kennedy, F.R.S., could not conceive any process more puzzling than the manufacture of a hollow tube from a solid bar, and it had been a great pleasure to him to hear the description of a process of such extraordinary difficulty brought to such a high state of practical perfection. The results of the tests were extremely good, taking into consideration the extreme thinness of the tubes operated upon, and the fact that the internal tube was by no means accurately finished in any way. The outside might be turned down, but the inside must be irregular, all of which irregularities would tend to weaken the tube; but in spite of this they had stood the test of compression.

The Chairman asked whether the 70-foot tube with a 3-inch bore had been produced from a solid bar in the rolls or drawn out on a draw-bench, and what length of bar was used to produce the 70 feet.

Mr. Gordon replied that it had not been drawn out in any way; it had been produced in several operations, but it was all done by rolling of that character, and was finished in the ordinary straight roll. The original bar was about 12 feet long, and it took four or five operations to produce the tube.

Mr. Alexander Siemens said some experiments had been made at the Charlton works to test the strength of the tubes, and although hydraulic pressure of three tons to the square inch had been used, they had not succeeded in breaking the pipes. It was evident that the tubes would lend themselves to a number of purposes; and as he understood they could be produced more cheaply than tubes in the ordinary way, he thought there was a great future before them. He quite agreed with the remarks made by the Chairman that the process was a most extraordinary one.

Mr. J. C. Chaplin said he should be glad to have some further information as to the method of working, for it seemed to him like turning a piece of metal inside out.

Mr. A. L. Jones said when listening to the way in which the tubes behaved themselves under internal pressure, he was struck by the analogy between them and copper tubes made by the Elmore process. He had seen a Mannesmann tube tested by internal pressure which swelled 50 per cent. in diameter, and an Elmore copper tube tested in the same way gave exactly similar results. He thought this pointed to a circumferential grain, like that in the Elmore copper tube. He should like to know what effect any inaccuracy in the adjusting of the rolls had on the central position of the hole, because it struck him that any inaccuracy would have the effect of making the hole eccentric, and so impair the utility of the tube.

Mr. Gordon said if it was a difficult process to understand, it was still more difficult to describe. It looked very simple when one saw it done —so did a conjuring trick—but it was a very difficult thing to say how it was done. As Mr. Chaplin had stated, it very much resembled the drawing of the material of the outside of the tube over the inside. He might say that yesterday he received from Germany a shorthand note of Professor Reuleaux's lecture on the subject, from which it appeared he used exactly the same simile, for he said it was like taking a fox's skin over his ears. As he understood it, the *modus operandi* was this—that while the grooved rolls were rotating at a high rate of speed, they tended to force the outer part of the metal forward, while the grip with the part of the rolls which was close together tended to retard the flow of the whole of the metal. The grooves pushed forward the outside of the metal, which was plastic, being of course at a high temperature, while by the grip of the roll the inner part was retarded, and thus formed into a cup shape, and consequently into a tube. In making tubes of a large diameter, the operation was greatly facilitated by the mandril, as it helped to retard the flow of the metal.

The Chairman asked whether the mandril was allowed to rotate.

Mr. Gordon—Certainly. The rolls need not necessarily be of the shape which he had shown in the photograph, but might be discs.

Mr. F.W. Fletcher said if metal (especially metals like soft steel) were rolled, there was a tendency for it to run with the rollers. The natural tendency was to follow the shape and direction of the rollers. At the Royal Institution, two or three years ago, Professor Roberts-Austen, when lecturing on metals and alloys, gave several illustrations proving the fact that rolled metals had an external tension. He thought the reason the metal formed itself into a tube was to be accounted for by the speed of the rollers.

The Chairman, by way of further explaining the possible action of the rollers, suggested that if four rolls were arranged so as to grip the rod on all four sides, while the rod was also held by four similar rolls running at a lower speed, it seemed to be clear that the grip of the bar of the front rolls would be resisted by the lesser speed of the back rolls, and the only way in which the two differences could accommodate themselves to one another was that the outer skin of the metal would be dragged forward as a sort of tube, just as the sleeve of the coat would be drawn off the arm if you passed your hand down along it. In conclusion, he begged to propose a hearty vote of thanks to Mr. Gordon for his interesting and instructive paper.

The vote was unanimously passed.

Gas Chatter.

By a PLEASED CONSUMER.

The fraternity, of course, have all had to do with the "indignant consumer;" alas! they know him too well. Hence it appears they are now to welcome with exceeding astonishment a "Pleased Consumer," who, by-the-way, comes to us with his pleadings from the great Lone Star State, a commonwealth that is ever bestowing on her sisters of the

starry flag great surprises and stupendous revelations. We may add that our "Pleased One" is located in Dallas City, which rather proves that Supt. Enfield is the greatest "converter" of them all. This *rara avis* thus chants his chatter:

Whatever competition gas, as an illuminant, may have to face in the future, it is certain that among artificial lights, for domestic purposes, coal gas is not only the best but most economical mode yet introduced.

Cradled in a country that claims the inventor of gas; reared within four miles of his birthplace, it is no wonder that the writer early imbibed the obvious advantages of this system of lighting.

I can laugh now at that little barefooted boy who would play truant from the school, and occasionally forget to come home to study, prefering to follow the lamp lighter with his ladder and lantern, while he made his lonely round of the village, and encourage him with a cheer as he succeeded in making darkness visible.

Nor can I forget the effect produced, when as the young man(?) of 14, I visited Glasgow in search of a fortune (yet to be made) and saw for the first time an engine at work with no visible motive power. When I learned it was a gas engine it only further roused my curiosity.

Gas Banquet.—Next I was introduced to a gasometer. The Glasgow Corporation had just completed a mammoth magnificent specimen, and ere the gas was admitted they built a stairway to the manhole and a grand stairway inside. Here the nobility and gentry were treated to a grand banquet and fared sumptuously, while we poorer folks (but just as good taxpayers) were admitted to behold the lovely arrangement of gas jets in appropriate devices, the splendid gravel walks, and the blooming plants elegantly laid out on the clay bottom, that a few days after held water and gas only.

From that day till the present I have been deeply interested in the study of the gas industry, and have watched its onward progress with unfeigned interest.

Gas Invented.—For one hundred and fifty years men of science turned their attention to the gases that streamed from the English mines, and about 1726 they succeeded in distilling gas from coal.

In 1792, however, we are indebted to a Scotchman, Wm. Murdoch, a native of Anchinleck, for the first application of gas to artificial lighting. In that year he lighted his house and offices at Redruth, Wales, and, some six years later, two factories.

1810 found a gas corporation chartered in London and preparations made to light Paris.

Gas Works.—Gas works, as a manufacturing industry to-day, occupy a very important position, employing an immense capital and creating demand for labor, for coal, iron, lime, brass and meters.

Without the aid of elaborate drawings it is impossible to describe the unique process of distillation, and space forbids more than mention of the benches, the retorts, the ovens and their arrangement, the stoking machines, the ascension and dip-pipes, the hydraulic mains, the tar well, the condenser, the exhauster, the washer, the purifier, the station meter. the gasholder, the governor, the gas main, the water traps, the house meters—wet and dry.

Beyond question it is an instructive process, and methinks an hour spent in your local gas works, in company with the affable manager, would prove at once interesting and profitable.

Various grades of coal are used. The English caking coals yield 8,000 to 10,000 cubic feet of gas per ton; illuminating power 12 to 16 candles. English cannel coal 10,000 cubic feet, with 20 to 24-candle power; and Scotch cannel coal 10,000 to 13,000, with 16 to 35-candle power.

American coals are richer in candle power than most English coals; notably so, Pittsburgh, Pa., second pool Youghiogheny, and the Breckenridge Kentucky cannel; but as a rule, less gas is made per ton.

It generally follows that the coal yielding the greatest quantity of gas likewise produces the highest illuminating powers.

From the most foul of the refuse products of gas distillation, coal tar, we receive many of our finest dyes. In the dark recesses of that inky fluid every color of the rainbow lie quietly imprisoned. In fact the products possible to be derived from coal tar are too numerous to mention; among them being the sweetest substance known.

Gas as an Illuminant.—Brilliancy of light, convenience, safety and cleanliness attend the use of gas. Too often we are taught by contrast, or learn to miss the water when the well runs dry.

Custom was second nature in that far away home beyond the seas, but when necessity forced us to an oil lamp in Texas, we took anything but kindly to the new order of things. Now that mains are extended, we have service, and night is turned into day, reading, writing and study come with renewed freshness, and the little flame of the old love was easily rekindled.

Explosions.—Under ordinary circumstances it is possible. One three-thousandth part present in the atmosphere is perceptible and highly disagreeable, and two hundred times that quantity in a closed room and a naked light are necessary to accomplish your purpose. Throw open your rooms, forget to apply a match, and your foul atmosphere will pass harmlessly away.

Cheerful Kitchens.—That the menial room of a house can be cosy cheerful and bright, is a lesson that has been taught Americans, fortunate enough to witness 'the old homestead.' What with the influence of the foreign-born element in our Western civilization, and the other agencies at work, we may soon look for model kitchens as a fashionable fad. These will always contain a gas stove. Even now visions pass before me of a cosy kitchen where

> "They round the ingle form a circle wide;
> The sire turns o'er, with patriarchal grace,
> The big Ha-Bible, once his father's pride."

It had a scrupulously clean, well scrubbed floor and wood work shining under rays from a bright gas jet. A treasure of a gas stove stood at one side of the hearth where burned a cheerful fire of coal and coke. Many a happy night has been spent here with friends, as we talked of home scenes and happenings, recounted the village gossip or dreamed of the new Western world.

Gas Cook Stoves.—If a gas stove is a luxury in Scotland, with its nine months of cold and three months of moderate heat, what ought it to be in Texas, with its nine months of semi-tropical heat and three months of pleasantly cool weather? They are in extensive use and becoming more popular every year. Besides being economical, there is an entire absence of dirt, smoke and smell, and a positive decrease in labor. And what a blessing to housekeepers in the morning. Husband anxious to get to business, children want to be dressed, breakfast is asked for in a hurry, and everybody is late. Under such circumstances did you ever find the kindling *not* split, the wood damp, or the coal fire slow? This sad experience is our common heritage. On such a morning a gas stove is an invaluable blessing. Tempers(?) are saved and time redeemed.

No preparation necessary, no gas to generate, no mending of fires, and no heat to regulate—nothing but to turn a faucet and apply a lighted match, and by the time toilet is completed the kettle is singing, the steak broiling, or the ham frying. Everybody wonders and blesses—first the inventor and then that thoughtful husband, brother, or friend that purchased that wonderful little gas stove.

Bunsen Burners.—"Oh, my! What an amount of gas you must consume!" is the common exclamation of first-time visitors to a gas stove. Yes! Just look at that flame: feel that powerful heat; the consumption must be great. Yes; but look again. The stove is supplied at every point with Bunsen burners. Bunsen! There's magic in that name. The ¼-inch iron pipe is severed in two, and through the air the gas is shot by a brass nozzle, with an orifice little larger than a pin head, and the atmosphere, being heavier, follows the olefiant gas; the two give forth a marvelous heat from a steady bright blue flame. This atmospheric burner is next thing to perfection in combustion and economy of fuel, and solves the problem of small gas bills on a cooking stove when properly managed.

Cooking.—We use a cast iron stove with four burners and two good-sized ovens. While more expensive than the more modest make of sheet iron, they are not costly and retain the heat better. Being finished with nickle plate trimmings, they are an ornament to any kitchen. Both ovens are heated at once. A perfectly even temperature can always be obtained, and, if necessary, vessels can be kept simmering for hours with smallest imaginable flame. The exercise of ordinary intelligence can suggest many economical ways for using these stoves. A slovenly housewife would first cook her roast or broil her chicken, and then bake her bread, while her prudent sister would be boiling and broiling, stewing and frying, baking and browning all at the same time; labor is saved, heat is economized, and gas bill kept within reasonable bounds. Meats are tenderer, more juicy and have a better flavor than when cooked in closed ovens or broiled over a coal fire. Fish at all times is a dainty dish in summer, but especially nice when cooked under the gas jets in the lower oven. Any recipe in the "department of the interior" can be cooked with success. For a family of four we cook three meals a day, bake all our bread, wash and iron the children's clothes (but give out washing for two), and the cost averages 9 cents per day.

Waste.—But what if hired help is employed! You mean wasting gas. How about the coal oil that saturates every thing, that is thrown on the fire, burned up the flue, endangering life and property? Wood needlessly, heedlessly wasted; coal ditto.

If there is one style of stove more than another completely under the control of the lady of the house, so far as fuel is concerned, that stove is the gas one.

Heat can be economized by the use of granite ironware. Tea kettles, stew pans, goblets, etc., should have perfectly flat bottoms and rather wide. These vessels may cost a trifle more to begin with, but are light and handsome, wholesome and durable, no heat escapes them and they cook and boil quickly.

Any lady or gentleman who can tell the time of day, can read a gas meter. If you cannot, do not fail to ask your collector to instruct you. Remember your gas company only visits your meter once a month, while you have access to it every day.

If you know anything to be wrong, give due notice of same and have the irregularity corrected. It is folly to scold the gas company and let the wrong go unremedied. I have heard many frivolous complaints of over charging, arising from a simple want of this precaution. How easy it is to burn jets all night and forget all about it on the first of the month I presume only gas men can tell.

Bathroom Stoves.—Instantaneous water heaters are a novelty. Have just seen a jewel of a gas attachment that heats water in a few minutes. Not being interested directly or indirectly in any gas stoves or corporation, have refrained from theorizing and confined remarks to conditions as they are found.

The Dallas water commissioners have not yet seen fit to lay 400 feet of pipe to supply twelve consumers; the gas company laid gas pipe the same distance for three consumers. When they do supply us with water I will have use for this latest device and will practically test its merits.

Hints to Consumers.—Avoid the unsatisfactory rubber hose attachment; rather use a ½-inch iron pipe and have the same properly fixed by a qualified gas-fitter, preferably the fitter of a gas company as they are interested. Have separate meters for lighting and one for gas stove. Learn to read your meter, and read it daily. Keep a record book; make your own entries, and verify gas bills by figures registered. Turn off the house meter every morning and turn it on again when the gold has faded in the west.

Reverse this order for your cook stove meter. Turning on the gas and then look for a match is all wrong. The fluid is wasted and the atmosphere contaminated. If you have children get a crown burner for the nursery. It never goes out, and only burns a tiny spark. Call on your gas manager for any assistance or advice needed. Finally—Don't give a dog a bad name unless he is a really mean cur.

Hints to Gas Managers.—Teach every consumer how to read the meter; supply them with wrenches to turn off gas. Have noted with pleasure the disposition of some enterprising managers to continue to supply a highly satisfactory quality of gas, and at the same time they are making periodical reductions in the price. Keep up the good work—everybody knows that twice the consumption costs you only a trifle more. The telegraph company give half rates for night service. Why don't *you* gas managers give us a special low price for gas used in cook stoves. It is a *day* business and *summer* business, and comes when you need it most—works, men and mains being partly idle. If Mill's economy is right, you can well afford it. Why no State fair exhibit? I have read of every conceivable convention in Texas—except a 'gas managers.' Get together in Dallas, read papers of practical value on the work or mechanism, the conditions and prospects of the gas industry generally. You will be warmly welcomed.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

At the annual meeting of the Mt. Holly (N. J.) Gas Light Company the following officers were chosen: President, Richard F. Mott; Secretary, Frank Woolman; Treasurer, Joshua Taylor.

About a week ago, and at a time when the thermometer in the "shady spots" of St. Louis was well up to the hundred mark, the outside gangs of the Laclede Gas Company, in view of the great physical sufferings they were undergoing, because of their labor out under the withering sun, in the main laying operations that were being conducted on behalf of the Company, informed Engineer Egner that they were about to strike for bigger pay. Now Egner is nothing if he is not a humanitarian, and feeling deeply for the prostration of the men, said he would not require them to suffer any longer. He accordingly paid them off and discharged them.

After a delay of nearly three months the Gas Commission of this city reassembled on the 26th inst., and virtually decided to reject all bids submitted by the companies for the electric lighting of the city on date of April 7. Proposals were then asked for the lighting of a total of 1,346 arcs, and the responses revealed an increase of about 4½ cents per arc per night over last year's contract rates. To cut a long story short, Commissioner Gilroy, at the session of June 26th, advised his colleagues (Mayor Grant and Controller Myers) to reject all the bids and negotiate for tenders, whereupon, should the new bids exceed the appropriations set apart for the purpose, gas should again be solely employed for the public lighting. A resolution to that effect was adopted, and Superintendent McCormick was instructed to advertise in the newspapers for new bids, the competition to close at noon of the 14th inst., and to make his preparations for maintaining gas lamps if the July competition proved that the electric lighting companies were not disposed to bring their figures within the maximum rates suggested by the Commission. Mr. McCormick was further directed to impress upon the electricians that their charges for the work they are now performing without contract must not exceed those paid them under the contract agreement of a year ago.

We understand that the County Board of Equalization (Indianapolis, Ind.) has raised the assessed value of the plant of the Indianapolis Gas Company, for the purposes of local taxation, to $600,000, from $200,000.

We are informed that the Clamond Gas Burner Company, of New York, has organized a branch Company for New Jersey, the office headquarters for which are to be at Jersey City. The stock is placed at $50,000, and the incorporators are Messrs. John S. S. Wood, H. H. Hollister, and A. R. Flower, of New York, and S. H. Henry, of New Jersey.

H. E. Gerhard, Treasurer of the Roanoke (Va.) Gas and Water Company, announces that the cash dividend of 4 per cent. on the capital of the Company is payable since the 1st inst. This Company is controlled by Philadelphia capitalists, whose home office is in the Bullit Building, that city.

Messrs. R. D. Wood & Co., of Philadelphia, Pa., and Camden, N. J., have purchased the Hopper patents which cover his automatic differential gas governor. They will continue the manufacture of this useful device, many specimens of which are giving good satisfaction at different gas works in the States and Canada.

Mr. Robert B. Taber has resigned as Secretary of the New Bedford (Mass.) Gas and Electric Light Company. We are sorry to hear it, and we hope that his resignation from that point virtually means promotion at another.

The City Fathers, of Worcester, Mass., recently held an animated conference, and the most prominent feature of the debate was in respect to the contracts for public lighting by electricity, which have been in abeyance for some time. A correspondent, in his report of the Council meeting, forwards us the following: "The order for making a three years' contract with the electric light company at the rate of 48 cents per lamp per night, which had been tabled at a previous meeting was recommitted to the committee on street lighting, and the minority report was also relegated to the same hands. It was then ordered that the street lighting committee confer with the electric light company with a view to securing from the latter a proposition to light the lamps, for a year from April 1, 1890, at a price not to exceed 40 cents per lamp per night. The report (supplementary) from the joint special committee on street lighting is as follows: 'The committee are not as yet prepared to report on the advisability of the city putting in a plant of its own, because much valuable information that had been asked for has not yet been received. Without going into detail, and giving a great deal of information which is at the disposal, however, of any member of the city Council who may ask for it, we give the following summary. A plant suitable to produce 201 (2,000-candle power) lights, to be built within one mile of the center of the city, would cost (exclusive of buildings) $34,490. The estimated cost to operate this plant, including 10 per cent. for interest and depreciation, would be $16,086.50, or $80.03 per light per annum, or 21 cents per night. The estimated cost of an electric light plant consisting of 400 (1,200-candle power) lights and 1,500 (25-candle power incandescent) lights, with the necessary apparatus, including land and buildings to cost $10,000, containing the plant, would be $98,000. The cost of operating this plant, including $9,860 for interest and depreciation, would be $35,954. The cost per year per light of 1,200-candle power would be $44.95, or 12 cents per night. The cost per night for 25-candle power incandescent lights would be 3 cents each. The city could light all of its streets (now lighted with 201 arcs, 509 gas and 1,657 gasoline), with a very much increased candle power over that at present

used, for about $36,000 per annum, including $9,860 for interest and renewal. It will be seen at once that if the amount expended at preseut on street lighting were appropriated the plant would entirely pay for itself in less than four years. In corroboration of the good policy of such installation and operation we have in our possession replies from 10 cities and towns now operating their own plants. In answer to our question whether, from their experience, they would advise a city to put in its own plant, the reply was invariably in the affirmative. Mr. J. M. Kennedy, City Clerk of Aurora, Ills., says: Always and all the time, yes. Five years ago we had a contract with a private corporation which furnished us 26 lights for $8,500 per annum. We now run 81 lights for for $5,402.24. Draw your own conclusions.—* * *.'"

Ex-Receiving Clerk Albert W. Lowry, of the main office, Philadelphia municipal gas works, when the latter system was in control of the power known as the Board of Trustees, was, on June 26th, awarded by referee's decision the balance of a year's salary, which he claimed from the city because he had been discharged before his year had expired. Mr. Lowry was engaged as Receiving Clerk by the Trustees on May 1, 1886, but was discharged on the following August at the solicitation of Trustee Henry Glass. The referee's report finds that when Mr. Glass was asked about the discharge of Mr. Lowry he had answered that there was nothing against the latter, but that he had another man for Lowry's place. When asked whether it (the discharge) could not be reconsidered, Mr. Glass replied that it could not, "because the man had already left the Pennsylvania Railroad Company's office to take Lowry's place. Lowry has been discharged, and that is the end of it. "Mr. Lowry's place was filled by the promotion of another clerk, Thomas Montgomery, who yet retains the position. Mr. Lowry's claim for salary for the whole year was based upon a by-law of the Board of Trustees which provided that all employees, excepting mechanics and laborers, should be elected annually, and should continue in office until the 1st day of May of the following year, unless sooner dismissed by a vote of the whole number of the Board of Trustees. No such vote was taken in Mr. Lowry's case, hence the referee (Mr. Henry M. Dubois) decided that the city, as the successor of the Board of Trustees, is liable to Mr. Lowry for $842.94, the balance of his salary for the year.

Some time ago we noted that one Cornelius Callahan had brought suit against the proprietors of the Troy Gas Light Company, alleging that the sum offered him for 362 shares in the Citizens Gas Light Company, of Troy, N. Y., was insufficient—the Citizens Company stock, or a majority of it, had agreed to form a part of the new Company that was to take over the different Companies of the city, and thus consolidate the business there of gas supply. Callahan wanted $50 for his stock, while the combination offered but $25. Appraisers—Messrs. J. Irving Wendell, of Albany, and Geo. A. Stone and J. Crawford Green, of Troy—were appointed to determine the value of the Callahan shares. The appraisers held several sessions at which many witnesses were examined, and on the 24th of June they submitted their report to Justice Edwards, sitting in special term at Albany. They favored the payment to plaintiff of $28 per share. No objection was made to confirming the report, but argument was had as to whether Callahan should be awarded costs. Judge Edwards decided this in the negative, whereupon the report was confirmed. The case will not be appealed.

The Belleville (Ills.) Electric Light and Power Company, which is virtually a branch of the Gas Company, has decided to install a Westinghouse electric lighting plant. It is to have power to maintain 75 arcs and 750 incandescent (16-candle power) lamps.

The Camden (N. J.) Gas Light Company has been awarded a contract for public street lighting, at the rate of $19.75 per lamp per annum, on an every and all-night table.

The following cleverly-compiled circular has been distributed to the citizens by the proprietors of the North Attleboro (Mass.) Gas Light Company, in furthering the spread in that city of the use of gas for purposes other than lighting:

"The convenience and comfort of cooking by gas can only be appreciated by those who have had experience in its extremely useful application to such purposes; and especially so during the summer months, when a fire is not required for other purposes. With gas there is neither kindling nor coal to be purchased, stored and handled, entailing upon consumers much labor, amounting, in an ordinary-sized family to the handling of at least twenty tons of coal during a single season, coupled with all the wear and tear of such handling. No ashes to be removed from the premises or scattered over the house, destroying furniture, carpets, etc. No time is wasted in making up and waiting for the fire to burn, or necessity for building the same sized fire for boiling a quart of water that you would to cook a dinner. The gas has only to be lighted and adjusted, the food placed in the oven, where, after a little experience, it may be so nicely timed as to require no further attention until it is done, when the gas can be instantly turned off, thereby saving the great and unavoidable waste inseparably connected with a coal fire. With a good gas cook stove the difficulties arising from *slow* fires, *quick* fires and *bright* fires vanish at once with the turning of a tap, admitting more or less gas as the circumstances of the case may require, the cook thus controlling the fire, instead of the fire controlling the cook. The loss of weight of meat cooked by gas is greatly diminished over that cooked by a coal fire. In the experiments made in the London Hospital it was found that meat roasted by coal fires lost 33½ per cent. of its weight, while the meat cooked by atmospheric gas lost 14 per cent. of its weight, and was found to retain more of its nutritive elements than when cooked in the old way; the juices and fat being no longer separated but thoroughly incorporated with the meat. It is but a short time since it was thought that a gas stove was only a tolerable makeshift for the plainest cooking, and for use in warm weather only. It is a little singular that so general a misapprehension should exist in regard to the economy as well as convenience of gas as a fuel. Many persons seem to have a general impression that the employment of gas for the purpose named is a luxury in which the rich may indulge, but which is too expensive for people whose necessities compel them to economize closely. The fact is—as demonstrated by figures that cannot deceive, and by the practical experience of years—that ordinary gas, at regular rates, is considerably less costly in use than coal and kindling, besides having important advantages in other respects. This general fact is becoming so widely recognized that the importance of gas for illumination, will, at no distant day, yield to the greater importance of the same agent in a wider and more useful application to human comfort, convenience and profit, by its use as fuel. Suppose it to be summer. The stove or range is found with its usual supply of glowing coal, presided over by the scarcely less glowing face of an irritated cook. The viands, we will say, are all prepared, and now, is the fire put out and the expense for fuel stopped? Quite the contrary. More coal is put on and the range or stove put in such condition that the fire may be available for the next meal, some hours later—it may not be till next morning. The only other alternative is to let the fire go out, to be rekindled at a still further expense of wood and fresh coal, to say nothing of a considerable loss of time in waiting for sufficient heat to commence cooking operations. Does it not strike one that the usual practice, as just quoted, is enormously bungling and wasteful? With the use of gas, precisely the opposite practice prevails. You turn on the gas only when ready to begin cooking, and at the end of the operation the expense is instantly stopped by turning it off. The time occupied may have been 20, 30, or 45 minutes, and this with an apparatus consuming, say, 6 feet of gas per hour, at, say $2.50 per 1,000, which is just one-quarter of a cent a foot, would be one-half, three-quarters or 1½ cents, respectively, for the fuel used in preparing the meal. At a lower price, of course, the cost will be relatively less."

The new holder for the Canton (O.) Gas Company will be built by the Davis & Farnum Mfg. Company.

The proprietors of the Natick (Mass.) Gas Light Company, at a meeting held something over a fortnight ago, discussed thoroughly the project of engaging in the supply of electricity. In fact, the meeting was called especially for that purpose. When all the testimony was in a vote was taken, which resulted in 173 shares voting in favor of the proposition, 7 shares being opposed. The total number of shares in the Company is 200. A petition for "leave to operate" will now be presented to the Board of Gas and Electric Light Commissioners.

Messrs. Hamilton & Balcomb and J. M. Peterson have purchased the old Smith street property of the Salem (Mass.) Gas Company.

It is virtually agreed upon that the proprietors of the Lawrence (Mass.) Gas Company shall, by purchase, acquire control of the plant and franchises of the local Edison Illuminating Company.

The Duluth (Minn.) City Council has passed an ordinance permitting the Duluth Gas and Water Company to extend its mains to West Du-

luth. The growth of the gas business at this point is little short of phenomenal.

ALD. MACKENZIE, seconded by Ald. Bryant, has finally carried his point of inducing the majority of the Board to authorize a reduction in gas rates at Alexandria, Va. The works at this point are operated by the municipality. The old rate was $1.80 per 1,000, with 10 per cent. off for prompt payment. The new schedule calls for a gross charge of $1.50 per 1,000, with 10 off, as before.

THE Bellingham Bay Gas Company, of Fairhaven, Wash., has been incorporated with a capital of $200,000.

TREASURER J. W. WHITMARSH, of the Brockton (Mass.) Gas Light Company, announces that the semi-annual dividend of 3½ per cent. is now payable.

THE Hon. A. B. Coffin, of the Massachusetts Gas and Electric Light Commission, who sailed for Europe on the Pavonia (Boston, June 28), was tendered a complimentary dinner, on the evening of the 27th, by his associates and Clerk Allen, of the Commission. During his stay abroad he will inspect the principal gas and electric plants of England and France. His wife accompanies him.

THE striking miners (they have been out for 8 weeks) formerly doing duty at the Oak Hill pits of the New York and Cleveland Gas Coal Company, have petitioned the pit committee to call a meeting to arbitrate the matters of difference between themselves and the Company. The latter will likely, however, install mining machines.

THE Louisville (Ky.) *Courier-Jaurnal* says that the city will name Messrs. W. J. Abrahams, Fred. Hoertz, J. W. Robinson and Harry Bishop as the four gentlemen to represent the city's interests in Board of Directors of the Louisville Gas Company.

ACCORDING to Boston (Mass.) advices, dated June 27, we are informed of the following: "The State Gas Commissioners this morning rendered an important decision concerning certain business interests at Wakefield. For three years there has been contention in Wakefield between the Citizens Gas Company and the People's Electric Company for the privilege of securing a plant for generating electric currents for house and street railway purposes. A third company, the Wakefield Electric Light Company, was in the contest at one time, but retired. The Peoples Electric Light Company petitioned the Selectmen for a charter and the general impression was that they would secure the desired consent. The Citizens Gas Company, which supplied the town with gas, was also desirous of having such a plant, and applied to the Supreme Court for an injunction to restrain the Selectmen from issuing the charter. That application was made early this year, and the injunction was granted. It was, however, afterwards dissolved, and the matter was referred to the State Commissioners. This morning the latter held a final hearing, and the Commissioners decided in favor of the Citizens Gas Company. The latter will now go ahead and establish a plant, something which the citizens of Wakefield have long been clamoring for. A company for the establishment of an electric street railway to run between Wakefield and Stoneham has been formed, and it is likely that it will be put into operation as soon as the electric plant of the Wakefield Gas Company is well under way."

THE London *Journal* is our authority for the statement that the Gas Light and Coke Company are about to adopt inclined retorts at their Beckton works. The Company's Engineer-in-Chief (Mr. G. C. Trewby) has devised an arrangement for facilitating the charging of the retorts, whereby they can be set at a greater angle, and consequently the coke discharged more easily, than on the Coze plan. A retort on Mr. Trewby's improved system has been in operation day and night at Beckton for upwards of 2 months, working 5 charges in 24 hours. It is 15 feet long, and set at an angle of 40°. The success attending it has led Mr. Trewby to recommend the Directors to erect 16 settings of 9 retorts each, making 144 mouthpieces, in one of the old houses where the arches have to be reconstructed. The recommendation has been adopted, and the retorts are expected to be ready for work by next winter. The charging machinery is being made by Mr. J. Ruscoe, of Hyde, near Manchester.

ADVICES from Ilion, N. Y., under date of June 28, are to the effect that the contract for erecting a complete electric light plant at that point has been awarded, by the Ilion and Mohawk Gas Light Company, to A. G. Greenburg, of the Fort Wayne Electric Company of New York city. The Wood system will be employed. The installation will be completed by Sept. 15.

MR. OSCAR F. HILT, the well-known bridge contractor, has just finished a truss roof for the upper generating plant of the Troy (N. Y.) Gas Company.

Spiral Weld Pipe for Gas Distribution.

By COL. J. A. PRICE, M.E., Scranton, Pa.

Pipe distribution of fuels is destined to supersede that of the car and the cart. It may be logically concluded that the consumption of solid fuel, with the drudgery of dirt it entails, will give way—as the bucket and pail to the faucet, or the hand lamp to the jet burner—to that invisible but potent fluid into which all carbonaceous material may be transformed.

Gaseous fuel is undoubtedly the fuel of the future, the merest conception of which involves the most extended consideration of piping, and contemplates such a system of conduits as has never before entered into calculation. The advent of the spiral weld construction seems to be exactly timed to the newly created wants, and will hasten the consummation of all that may be wished as to capacity, safety and cost, as no other known construction is able to do. The increase of the utilization of the waste of mining and of cities, consisting of all kinds of refuse and garbage, lies along the line of gasifying carbon.

With this new factor fully entered into our industrial life and domestic economy, the demand for increased diameters of piping will be continuous, and must become very assertive. In this respect, the spirally welded construction seems to be practically far beyond the reach of any competition. This demand as to size will be positive, as the lower grade of gases for fuel comes to the front, and as the pipe friction of long distance transmission is considered. It may be set down as established that the lower grade of fuel gas, with its greater quality of safety, will serve the largest purpose in household and industrial uses. The gases that are constituted of the purely combustible compounds, such as the hydrocarbons of illuminating gas, carbonic oxide and hydrogen of water gas, etc., are much more costly to manufacture than those out of which the diluents, such as nitrogen and carbonic acid, are not eliminated by any mechanical process, but which, as in the case of producer gas, are allowed to pass as floaters to the more valuable material. Hence, large pipes are a necessity.

The light weight, the possible long sections, and the undoubted reenforcement of material found in the spirally welded pipe, appear to warrant for it the widest field of usefulness. The loss of gas between the producer and the meter, or that which is unaccounted for, is largely due to joints. In this respect the advantage of spirally welded tubes is conspicuous and beyond dispute, and it becomes more evident as the size increases. Without entering into technical details, these assertion must be admitted by those of even limited experience in gas distribution.

Leading up from these considerations of the silent forces which we are able to render serviceable by means of piping, in substituting the conduit for the car, etc., there is, perhaps, also an interesting field for speculation, which is full of suggestiveness, comprehended in the possibilities of pneumatic tube service and the extent to which it may be enlarged. As we have practically abandoned the roadway for the train, may we not still further, in many departments of distribution, substitute the tube for the rail? Pneumatic tube service is increasing, and large, secure, cheap tubing (characteristics of the spiral weld) will surely enlarge its usefulness and contribute to its extension in directions and into use which may have hitherto been considered impossible, impracticable and unwarranted. Who can estimate what may or may not become perfectly reasonable and assured when the mechanical problems are once solved? We may surely expect from the traffic of the pipe and the flue as great things as have ever come to us along other lines. Here also the efficiency of the spirally welded construction is largely suggestive, constantly rendering the desired end less remote.

I am also of the conviction that the construction possesses qualities that may fit it to become the solution of the "iron tie" problem in railway construction, in place of the wooden one. It ought to be tested in this employment. A succession of hollow cylindrical beams, capable of so great a resistance to every strain from whatever source or direction—at once cushions and reliable supports—may revolutionize railway construction and give us the ideal roadbed of coming time.

SUPERINTENDENT WANTED

For a small but nearly new and fairly well built and arranged Gas Works. Qualities required are, first, that the interests of the owners and superintendent shall be identical; second, ability and willingness to work; third, tact to deal with consumers in such a way as to hold trade in spite of opposition. Temperance a pre-requisite. Supt. engaged will have entire charge of plant, including books, with no interference except an occasional consultation with the undersigned. Salary, $1,200. Address

785-2 C. E. BURROWS, Walla Walla, Washington.

SITUATION WANTED

As Superintendent of a Gas Works,

By a man of 20 years' experience. Best of references. Address JOHN COLLINS,

324 Clinton Street,

788-tf Schenectady, N. Y.

WANTED,

A Six-Inch Exhauster.

SECOND-HAND.

Must be in good condition. Roots' make preferred. Address POUGHKEEPSIE GAS CO.,

783- Poughkeepsie, N. Y.

FOR SALE,

A Well-Located Gas Works,

Supplying a portion of a large city, and paying good interest on investment. Capable of large extension. Has small bonded debt. A party who will put in $10,000 to $15,000 worth of extensions will receive two-thirds stock interest and management of business, the present owners having other business requiring their entire attention. An excellent opportunity for profitable investment. Address LOCK BOX 19,

787-9 Norristown, Pa.

FOR SALE,

One 12-Inch Air Condenser.

One Multitubular Condenser.

One Anderson Washer.

Six 12-Inch Chapman Valves.

For particulars apply to NEW HAVEN (CONN.) GAS CO.

FOR SALE.

GAS LIGHT PLANT,

In a growing town of 5,000 inhabitants. Oil Gas Process. For particulars address LATROBE GAS COMPANY,

784-6 Latrobe, Pa.

FOR SALE.

One 5-ft. Station Meter,

8-inch Connections.

In good order. Price, $300, f.o.b. at Poughkeepsie, N. Y. POUGHKEEPSIE GAS CO.,

783-tf Poughkeepsie, N. Y.

FOR SALE,

The Ironwork for Ten Benches of Fives (5's).

Cast iron Hydraulic Main, 16 by 18 in. Stand Pipes, 5 in. at bottom, 4 in. at top. Bridge and Dip Pipes, 4 in. Address DAYTON GAS LIGHT AND COKE CO.,

783-tf 120 East Third Street, Dayton, Ohio.

WANTED TO LEASE

A Small Gas Works,

By a practical gas man. Address

784-8 "W. E. F." care this Journal.

The New York Oxygen Co.,

No. 80 Broadway,

Are prepared to give full information on the application of Oxygen to the purification of lighting gas.

Bartlett Street Lamp Mfg. Co.

MANUFACTURERS OF

Globe Lamps,

FOR

Streets, Parks, Public Buildings, Railroad Stations, etc.

LAMP POSTS

A Specialty.

Office and Salesroom,

40 & 42 COLLEGE PLACE, - - N. Y. CITY.

Gas Companies and others intending to erect Lamps and Posts will do well to communicate with us.

Engines and Boilers For Sale

Five 80-H.P. Ft. W. Buss Automatic Cut-Off Engines, 12 by 16 in.

Three 40-H.P. Armington & Sims Automatic Cut-Off Engines, 9 by 12 in.

One 50-H.P. New York Safety Automatic Cut-Off Engine, 10 by 12 in.

Four Tubular Boilers, Steel, 16 ft. by 60 in., forty-four 4 in. flues. Full front.

Two Tubular Boilers, Steel, 16 ft. by 60 in., eighty 3-in. flues. Full front.

One No. 5 Dean Pump.

Three Sets J. H. Turner Patent Heaters.

The above are in good condition and in operation. Write for particulars.

JENNEY ELECTRIC LIGHT AND POWER CO.,

783-tf Peoria, Ills.

FORT WAYNE ELECTRIC CO.

FORT WAYNE, IND.

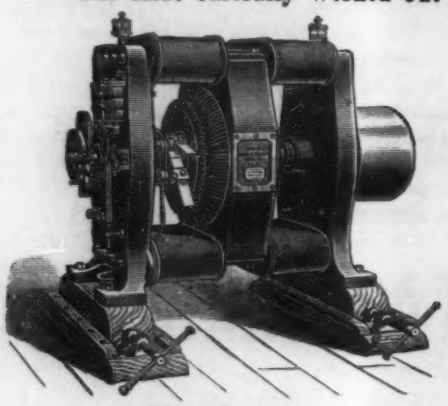
MANUFACTURERS OF THE

Slattery Induction System

—OF—

LONG DISTANCE INCANDESCENT LIGHTING.

The Most Carefully Worked Out and Complete Alternating Current System of Electric Lighting in Existence.



Wood Dynamo.

— AND THE —

WOOD

Automatically Regulating

ARC DYNAMOS and LAMPS.

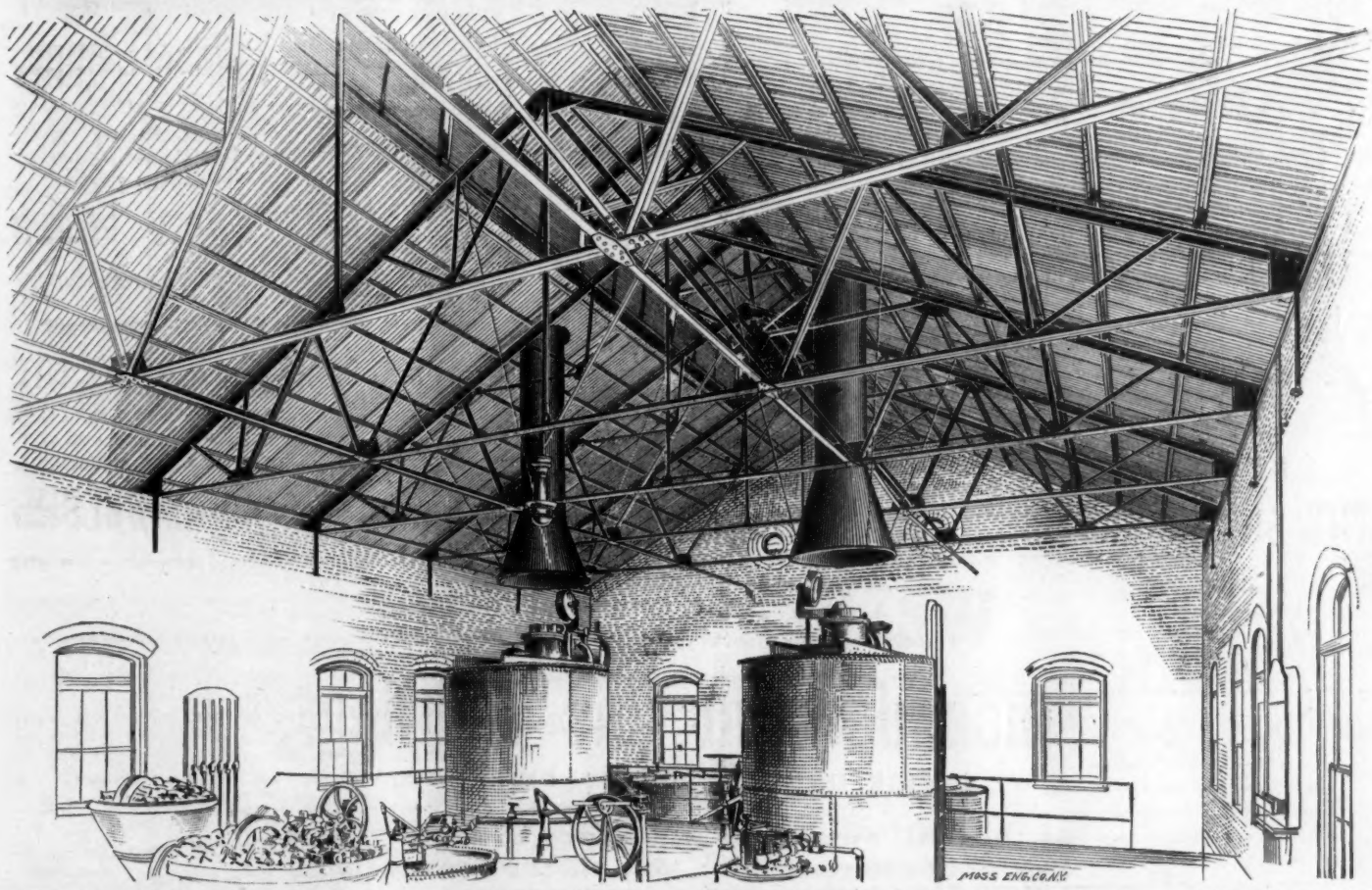
Main Office, - - - Fort Wayne, Indiana.

Factories: Fort Wayne, Ind.; Brooklyn, N. Y.

BRANCH OFFICES.

NEW YORK, - - - - - -	115 Broadway.
PHILADELPHIA, - - - - -	907 Filbert Street.
CHICAGO, - - - - -	185 Dearborn Street.
SAN FRANCISCO, - -	35 New Montgomery Street.
DETROIT, MICH., - - -	57 Gratiot Avenue.
TORONTO, CANADA, - -	138 King Street, West.
MEXICO, F. Adams' Successors, - -	City of Mexico.
CUBA, Maicas & Co., - - - - -	Havana

THE BERLIN IRON BRIDGE CO.



The above illustration is taken direct from a photograph of an iron roof built by us for the Providence Gas Company, at Providence, R. I. The roof is built entirely of iron—iron trusses, iron purlins, covered with corrugated iron. There is not a particle of woodwork anywhere about the roof, thus making it absolutely fireproof. Notice that along the peak of the roof there is a corrugated iron ventilator, with iron shutters opening and closing by cords from the floor, thus securing perfect ventilation. *Write for Illustrated Catalogue.*

Office and Works, EAST BERLIN, CONN.

The Hot Water Problem Solved.

The most serious drawback to the general introduction and use of Gas for domestic purposes has been the supply of hot water. The only way of heating water heretofore has been by a separate attachment, which is both inconvenient and adds materially to the expense.

We are pleased to say to those interested that after many experiments we have been entirely successful in making a Gas Range with an ATTACHMENT FOR HEATING WATER AS A PART OF THE RANGE, direct from the burners, while the Range is being used for cooking and general domestic work, in the same manner as water is heated by the ordinary coal or wood range. A large number of these Ranges are now in DAILY USE, GIVING PERFECT SATISFACTION, not only for supplying hot water, but in all other respects. Our price and discounts to the trade are liberal and satisfactory. For further information address

THE DANGLER STOVE AND MFG. COMPANY,
Cleveland. Ohio.

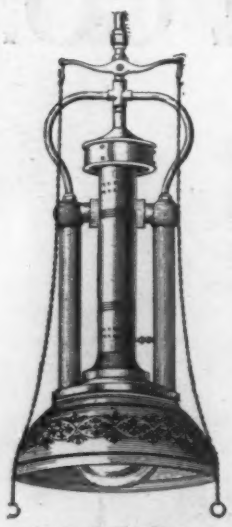
CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

THE MARYLAND METER AND MANUFACTURING CO.

Established 1866.

BALTIMORE, North & Saratoga Sts. **CHICAGO, 197 Michigan Street.**
NEW YORK, 766 Broadway. **BOSTON, 4 Central Street.** **ST. LOUIS, 1115 Olive Street.**
SAN FRANCISCO, 330 Pine Street.

CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.
"Success" and "Perfect" Gas Stoves.

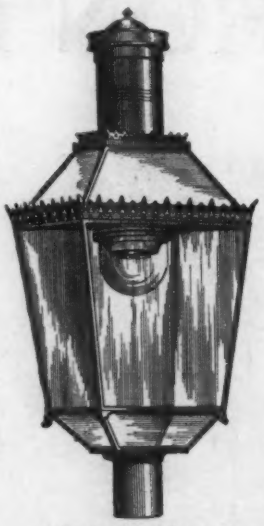

Gordon Portico Lamp.

The Gordon Portico Lamp.

A successful Competitor of the Arc Electric Light for lighting Store Fronts, Show Windows, Depots, Railway Sheds, etc., etc.

The Gordon Street Lamp.

A Successful Competitor of the Arc Electric Light for lighting Streets, etc., etc.


Gordon Street Lamp.

The Lungren Lamp.

A Successful Competitor of the Incandescent Electric Light for Interiors, etc. Is especially applicable for the lighting of Offices, Stores Factories, Mills, Show Windows, Libraries, and all situations where an increased illumination is desired.

More than 25,000 Lungren Lamps are now in use. Testimonials, references, or any desired information will be cheerfully given.

Lungren Lamp.

THE SIEMENS-LUNGREN CO., N.E. Cor. 21st St. & Washington Av., PHILADELPHIA.

WELSBACH SYSTEM
OF
Incandescent Gas Lighting.

OFFICE, DREXEL BUILDING, PHILA., PA.

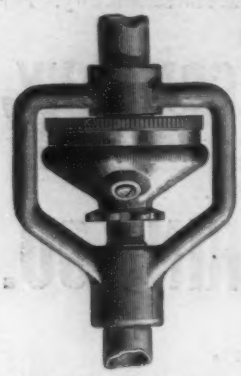
At the Fall Session of the Board of Supervisors of Winnebago County, held at the County Court House, Oshkosh, Wis., Nov. 26, 1889, the report submitted by Mr. C. W. Cook, Chairman of the Committee on Public Buildings, recommending the use of the Welsbach Incandescent Gas Burner in the Buildings under their charge, was unanimously adopted, because of the extreme economy in the consumption of Gas and the superior character of the light obtained.

MOSES G. WILDER, MECH. ENGR.

816-18-20-22 Cherry St., Phila., Pa.

Volumetric Lamp Governors

FOR GAS LAMPS & HIGH-POWER BURNERS.



GOVERNOR BURNERS
for
STREET LAMPS AND GENERAL USE,
and
GOVERNORS FOR ARGAND AND OTHER COMMON GAS BURNERS IN ALL SIZES.

HORIZONTAL
Governors
Specially adapted for
GAS STOVES, FURNACES, Etc., Etc.

It is well known that a large majority of all High Power Gas Lamps in the United States have my Governors attached, and they are always used by the leading makers of these lamps. To remove any excuse for the use by anyone of inferior and infringing Governors, a reduction in price has been made, and all exclusive contracts are cancelled.

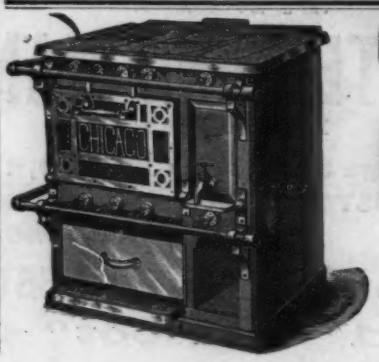
Correspondence Solicited with all who require a Reliable Governor.

BALL AUTOMATIC CUT OFF ENGINE
MADE ONLY BY
THE BALL ENGINE CO
ERIE PA.

COMPLETE STEAM PUMP
10 SIZES FROM $7 TO $75
FOR WATER SUPPLY TANKS, FIRE PUMPS & ETC.
WRITE FOR PRICES AND DESCRIPTIVE CIRCULARS
VAN DUZEN & TIFT
SOLE MAKERS
CINCINNATI, O.

GASHOLDER PAINT.

Use Only
THE GOVERNMENT WATERPROOF PAINT.
Proof against Ammonia, and Absolutely Waterproof. Send for Prices and Particulars.
THE GOVERNMENT WATERPROOF PAINT CO., 122 Milk Street, Boston, Mass.



CHICAGO GAS STOVE CO.

MANUFACTURERS OF ALL KINDS OF
Gas Cooking and Heating
APPLIANCES.
117-119 Lake St., CHICAGO.
Send for Catalogue.

JEWEL GAS STOVES

Are Best,

BECAUSE THEY ARE

HIGH GRADE,

Interchangeable,

RIGHT!

WE USE NO GAS COCKS.

All Flames are Regulated by Direct Needle Valves.

JEWEL CIRCULATING WATER HEATER.

No. 510, - - - - - - $15.00.

Write for Jewel 1890 Catalog.

GEORGE M. CLARK & COMPANY,

MANUFACTURERS,

157 & 159 Superior Street, - - - Chicago, Ill.

NATIONAL GAS LIGHT AND FUEL CO.,

218 La Salle Street, Chicago.

C. D. HAUK, Prest. & Gen'l Manager. A. W. GREEN, Vice-Prest. N. A. McCLARY, Sec. & Treas. E. E. MORRELL, Engr.

GAS WORKS

Built, Remodeled, Leased, and Purchased.

71 Springer Cupolas have been installed in the U. S. during the past four years.

The total capacity of Springer Apparatus now in use is over 25,000,000 ft. daily.

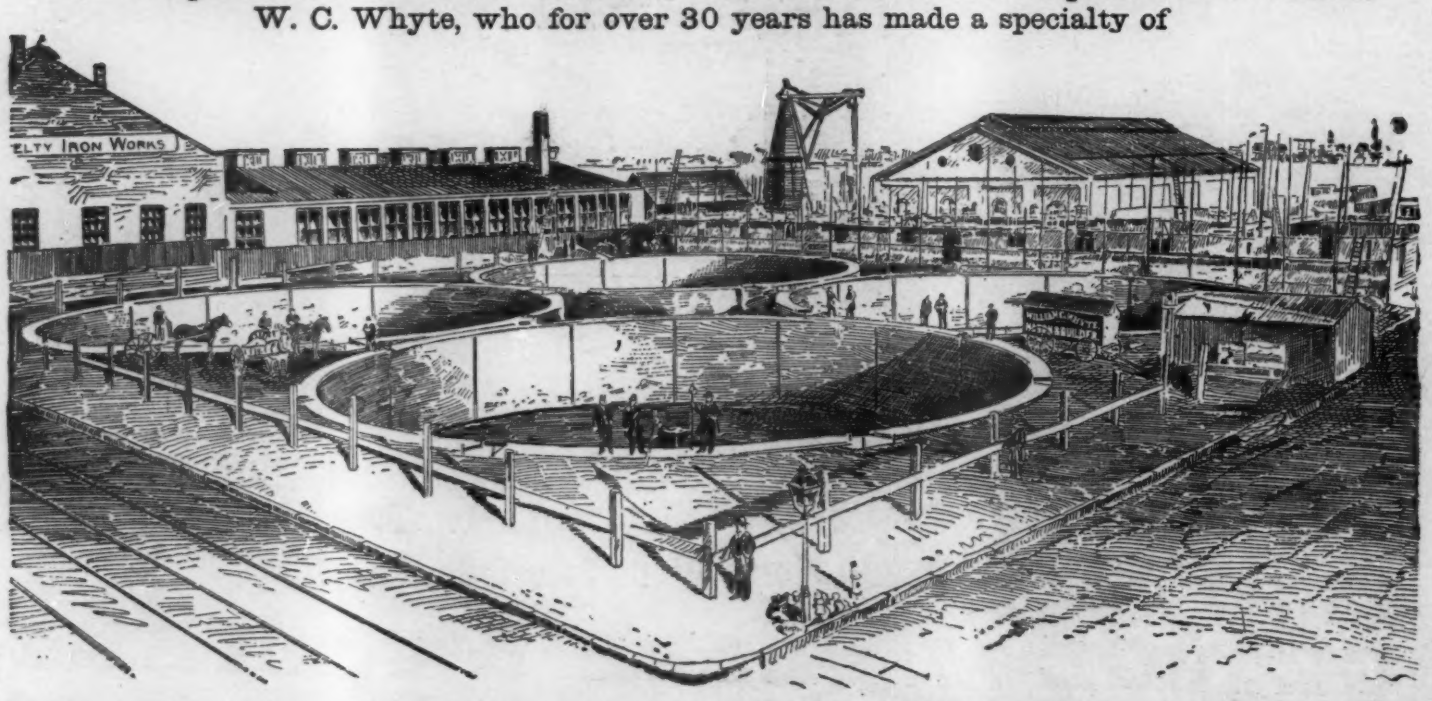
THE SPRINGER CUPOLA SYSTEM

Has Proven Itself the most Economical and Satisfactory Method of Gas Manufacture ever brought to the attention of the Gas Fraternity.

GUARANTEED ESTIMATES of Cost of Gas Furnished on Application.

GASHOLDER TANK CONSTRUCTION, ETC.

Gas Companies and others about to erect Gasholders will find it profitable to consult W. C. Whyte, who for over 30 years has made a specialty of



Tank Excavation and Mason Work.

Fifty Tanks now in operation show the sort of work done. Address

W. C. WHYTE, - No. 15 Cortlandt Street, N. Y. City.

GAS STOVES. GAS METERS. GAS STOVES.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

MANUFACTURERS OF

Standard 3 Diaphragm Dry Meter.

Gas Meters,

STATION METERS,

METER PROVERS, PHOTOMETERS,

Pressure Gauges of all Kinds,

AND

Standard 2 Diaphragm Dry Meter.

Apparatus for Testing the Quantity and Quality of Gases.

GAS STOVES FOR HEATING AND COOKING.

Circulars and Price Lists on Application.

MANUFACTORIES,

508 to 514 West Twenty-second St., N. Y. Arch and Twenty-second St., Phila.

Nos. 244 & 246 North Wells Street, Chicago, Ill.

AGENCIES,

No. 177 Elm Street, Cincinnati, Ohio. No. 222 Sutter Street, San Francisco, Cal.

No. 810 North Second Street, St. Louis, Mo.

GAS STOVE SHOW ROOMS, No. 242 Sixth Avenue, New York City.

THE
WALKER TAR AND CARBONIC ACID EXTRACTOR.

A very general demand exists, in both large and small Gas Works, for an apparatus that will be absolutely efficient in the removal of the tar which passes the hydraulic main and condenser. Many attempts have been made to accomplish this, but, I believe, without success, until the introduction, five years ago, in England, of the C. & W Walker Patent Tar and Carbonic Acid Extractor. During these years this apparatus has been adopted by many of the most prominent Engineers, not only in England, but also on the Continent of Europe and in other parts of the world. It is only necessary to give here a partial list in order to convince any intelligent American Gas Engineer that this machine must have succeeded fully in accomplishing the desired results.

The following Engineers have personally given permission to refer to them:

G. C. Trewby, Esq., Engineer-in-Chief of the Gas Light and Coke Co., London. The manufacturing plant at Beckton is built in complete sections of 3,000,000 cubic feet capacity each. A Walker Tar Extractor has been fitted to each one of these sections. This was done after a long and thorough trial on one of its sections. The Tar Extractor has been supplied to other works of the Gas Light and Coke Co., including those of which John Methven, Engineer of the Gas Light and Coke Co. at the Nine Elms Station, is in charge. Also to G. E. Stevenson, Peterborough Gas Works; B. Green, Mitcham and Wimbledon Gas Works; W. H. Smith, Bedford Gas Works; F. Linging, Norwich Gas Works; J. T. Browning, Colchester Gas Works; S. B. Darwin, Portsmouth Gas Works; J. McCrae, Dundee Gas Works; W. J. Wells, Stamford Gas Works; J. M. Darwin, Longton Gas Works; J. Paterson, Warrington Gas Works; and J. Coulter, of the Dundalk Gas Works. All of the foregoing gas works are located in Great Britain.

Mr. Charles A. Gerdenier, Superintendent of the Bridgeport (Conn.) Gas Light Company, writes as follows, under date of Dec. 3, 1887:

"The C. & W. Walker Tar and Carbonic Acid Extractor has been in operation at these works for the past six weeks, and is an unqualified success. It removes every particle of Tar from the gas in once passing through the apparatus, and a large percentage of the Carbonic Acid. I also feel quite sure that it prevents the formation and deposit of Naphthaline, because since I started the Washer I have had no stoppages from this cause. These works have been seriously troubled with Tar for many years, and I have used several kinds of apparatus and every expedient which has come to my attention for dealing with the difficulty, but without success. The Walker apparatus occupies comparatively small space, is less expensive than other systems, and requires but little attention. I carry 2½-inch seal, and have an automatic tar delivery valve. This Tar Extractor is indispensable to gas makers."

I have taken the Agency for the United States for this apparatus, and am now prepared to make contracts to erect it on the premises of any Gas Company. It would be manufactured in the following sizes:

No. 1,	50,000	to	100,000	cu.	ft.	per	24 hrs.,	3	ft.	square,	5 ft. deep.
No. 2,	"	"	125,000	"	"	"	4	"	"	"	"
No. 3,	"	"	250,000	"	"	"	5	"	"	"	"
No. 4,	"	"	500,000	"	"	"	6	"	"	"	"
No. 5,	"	"	750,000	"	"	"	7	"	"	"	
No. 6,	"	"	1,000,000	"	"	"	8	"	"	"	
No. 7,	"	"	1,250,000	"	"	"	9	"	"	"	"
No. 8,	"	"	1,500,000	"	"	"	10	"	"	"	"
No. 9,	"	"	2,000,000	"	"	"	12	"	"	"	"
No. 10,	"	"	3,000,000	"	"	"	15	"	"	"	"

This Tar Extractor will perform its work with about one-fourth the usual back-pressure heretofore required. It is simple in construction, and can be supplied at a very reasonable price—less than any other ever before introduced. Satisfactory results will be guaranteed in every instance.

GEO. SHEPARD PAGE,

SOLE AGENT FOR THE UNITED STATES,

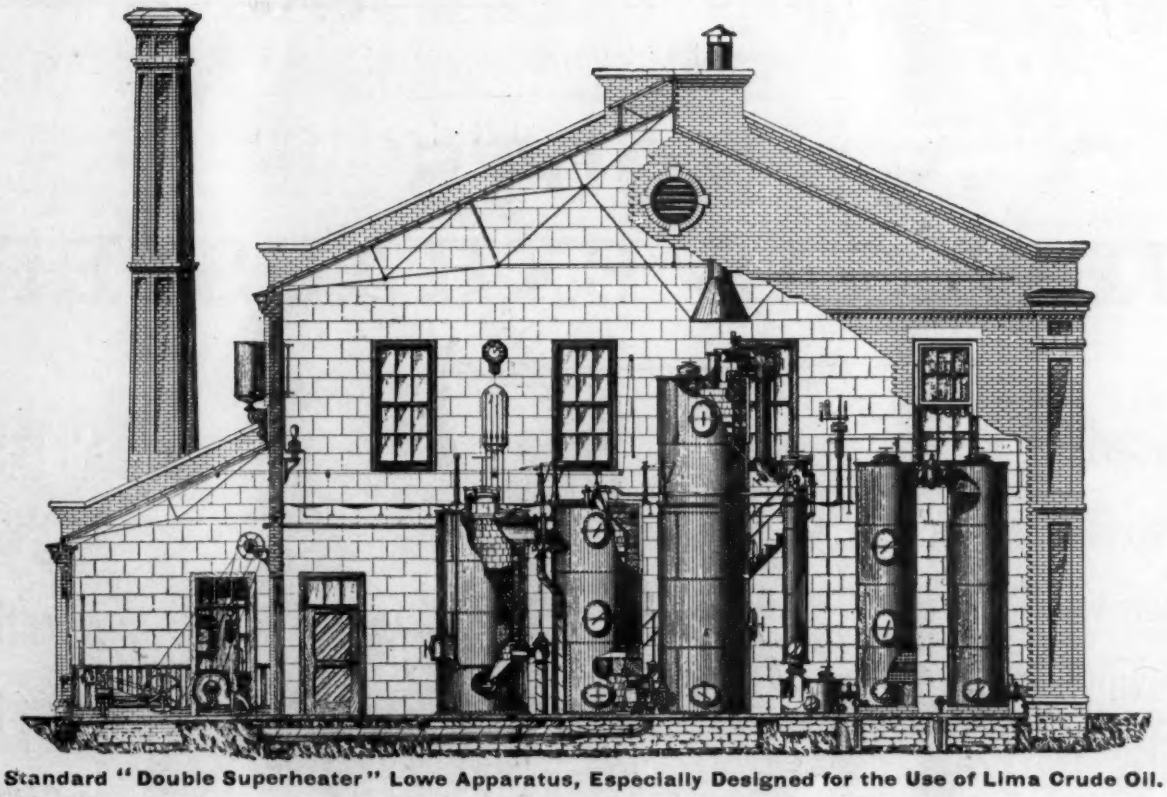
No. 69 Wall Street, - - - New York.

THE UNITED GAS IMPROVEMENT CO.,

DREXEL BUILDING, PHILA., PA.

Owners of the Lowe, Granger-Collins, McKay-Critchlow (for carbureting Natural Gas), and Other Gas Patents.

BUILDERS, LESSORS and PURCHASERS OF GAS WORKS.



Standard "Double Superheater" Lowe Apparatus, Especially Designed for the Use of Lima Crude Oil.

Erectors of

WATER GAS PLANTS,

(Either Independent or Auxiliary to Coal Gas Works),

USING LIMA OR OTHER LOW GRADE OILS AND ANTHRACITE COAL OR GAS HOUSE OR OVEN COKE.

PAMPHLETS, PLANS, AND ESTIMATES FURNISHED UPON APPLICATION.

ROOTS'
GAS AND BYE-PASS VALVES.

GAS VALVE

Quick Acting,
Simple,
Efficient, Durable.

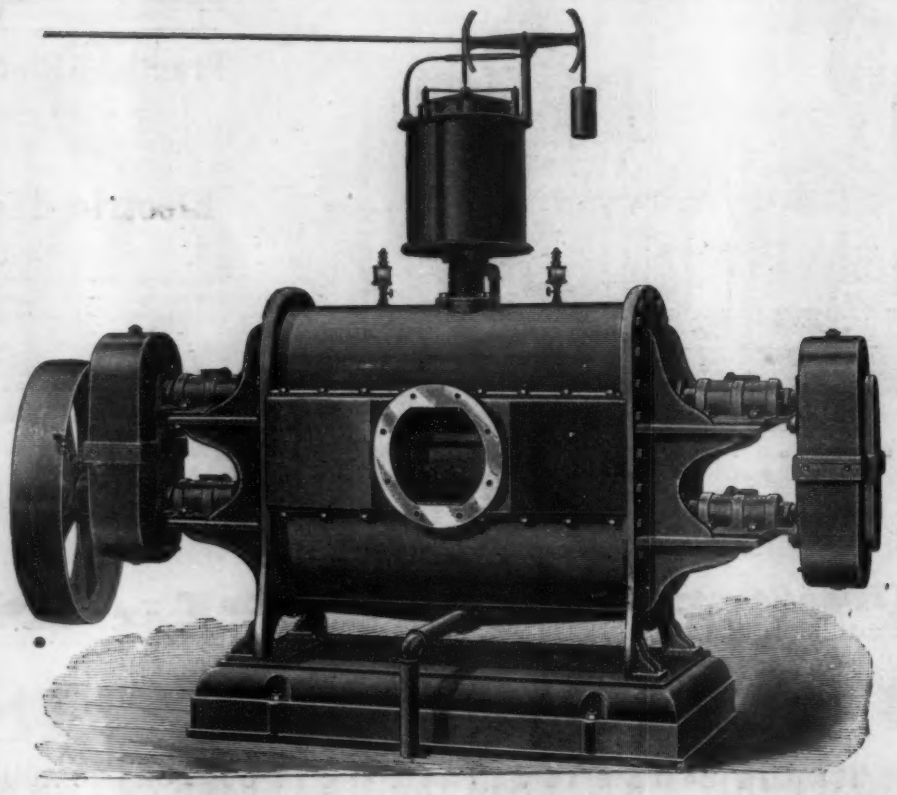
BYE-PASS VALVE.

Automatic Action
Reliable
Simple Durable.

Thousands now in use and giving perfect satisfaction. Write for Catalogue and Prices.

ROOTS'
NEW GAS EXHAUSTER.

Unsurpassed for Neatness of Design, Durability, Simplicity, Efficiency, and Economy of Power.



All Parts Requiring Attention are External and Easily Accessible at all Times.

Send for Descriptive Catalogue and Price List.

THE P. H. & F. M. ROOTS CO., Patentees and Manufacturers, **CONNERSVILLE, IND.**

S. S. TOWNSEND, Gen. Agt., 22 Cortlandt St., N. Y. COOKE & CO., Selling Agts., 22 Cortlandt St., N. Y.

CONNELLY & CO.,

SOLE MANUFACTURERS OF THEIR PATENTED SPECIALTIES.

"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying agent ever offered as a substitute for lime. Now used *in every State in the Union*, and purifying daily over *thirty-five million cubic feet.* Should be used in every gas works. Its own saving will pay for it many times over.

AUTOMATIC GOVERNOR. Has been on the market but *three years*, and in that time has been introduced *more generally* than any invention ever designed for use in gas works. Over *two hundred* of them now in use. Sensitive; reliable; perfectly automatic; reduces leakage; satisfies consumers, and gives great relief to the Manager. No gas works is *complete* without one of these machines.

STEAM JET EXHAUSTER. Designed particularly for small works Combines Exhaust Tube, Steam Governor Gas Compensator, and Bye-Pass Valves in the most compact form possible; occupies but little space; uses very little steam; operated by ordinary workmen; saves formation of carbon in retorts; increases yield 10 to 15 per cent. Specially adapted for *mixing air* with oil gas. *No works* too small to use them profitably.

Prices given on all our specialties *delivered at any point in the United States.* Correspondence solicited.

CONNELLY & CO., No. 111 Broadway, New York City.

WILBRAHAM

GAS EXHAUSTER & ENGINE COMBINED.

WILBRAHAM BROS.,

PHILADELPHIA, PA.

JARVIS ENGINEERING CO.,

61 Oliver St., Boston, Mass.

CONTRACTORS FOR ERECTING

COMPLETE STEAM OUTFITS FOR ELECTRIC LIGHTING STATIONS.

Steel Boilers set with Jarvis Pat. Boiler Setting

To burn **COKE SCREENINGS** for Fuel.

ARMINGTON & SIMS CO. ENGINES,

Belting direct to Dynamos, without using Shafting.

SEND FOR CIRCULARS.

REFERENCES.—Charlestown Gas & Electric Light Co., Charlestown, Mass.; Schenectady Gas & Electric Light Co., Schenectady N. Y.; Brookline Gas Co., Brookline, Mass.

Practical Electric Lighting

By A. BROMLEY HOLMES, A.M.I.C.E.

With 87 Illustrations. Third Edition. **Price, $1.00**

Electric Light Primer.

By CHARLES L. LLVEY.

A simple and comprehensive Digest of all the most important facts connected with the running of the Dynamo and Electric Lights, with Precautions for Safety, etc.

Price, 30 cents.

A. M. CALLENDER & CO., 42 Pine St., N.Y

Gasholder Tanks & Gas Works Masonry Complete.

PLANS PREPARED AND ESTIMATES FURNISHED AT SHORT NOTICE.

J. P. WHITTIER, 70 Rush St., near Division Av., Brooklyn, N. Y.

1890 DIRECTORY 1890

OF THE GAS LIGHT COMPANIES of the UNITED STATES & CANADA.

Price, - - - - - - - $5.00.

A. M. CALLENDER & CO., No. 42 Pine Street, N. Y. City.

CHAPMAN VALVE MANUFACTURING CO.,

MANUFACTURERS OF

Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Gate Fire Hydrants With and Without Independent Nozzle Valve. All Work Guaranteed.

WORKS & GEN'L OFFICE: Indian Orchard, Mass.

TREASURER'S OFFICE: 72 Kilby & 112 Milk Sts, Boston, Mass.

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER.

FOR UTILIZING COAL TAR AS FUEL.

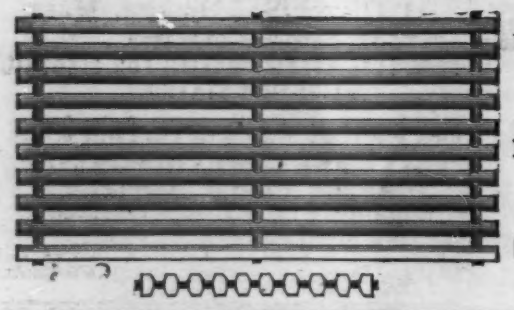
PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial.* No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.

H. E. PARSON. Supt., 33 & 35 Liberty St., N.Y

MILLS' REVERSIBLE LIME TRAY,



AND

WOODWORK

Of Every Description

NEEDED BY GAS WORKS.

SEND FOR CIRCULAR AND PRICE LIST TO

BARTLETT, HAYWARD & CO.,

Pratt and Scott Streets, Baltimore, Md.

VAN DUZEN GAS & GASOLINE ENGINE

OPERATED with COAL and OTHER MANUFACTURED GASES AND GASOLINE.

RELIABLE AND ECONOMICAL.

Fully Warranted

VAN DUZEN Gas & Gasoline Engine Co. 49 E. 2d St., Cincinnati, O.

A. MacKinnon Machine Co., Agts., 22 Warren St., N.Y.

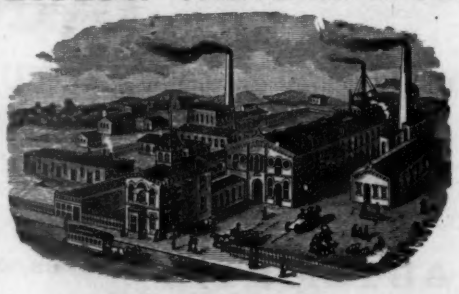
The Management of Small Gas Works.

BY C. J. R. HUMPHREYS.

Price, $1.

Orders to be sent to **A. M. CALLENDER & CO.,** 43 PINE STREET, NEW YORK.

LUDLOW VALVE MFG. CO.

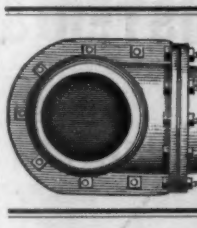


OFFICE AND WORKS,

938 to 954 River Street and 67 to 83 Vail Av.. TROY, N. Y.

Hydraulic Main Dip Regulators, also Check Valves, Foot Valves, Yard-wash and Fire Hydrants. Send for Circulars.

Valves.—Double and Single Gate, ¾ in. to 48 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, and Oil. Send for Circulars.



John McLean

Man'facturer

GAS VALVES.

298 Monroe Street, N. Y.

SPECIAL TRAYS FOR IRON SPONGE OR OXIDE OF IRON.

CHURCH'S TRAYS A SPECIALTY.

REVERSIBLE-STRONGEST-MOST DURABLE-MOST EASILY REPAIRED.

JOHN CABOT. TRAYS FOR GAS WORKS.

306-310 ELEVENTH AVENUE, NEW YORK.

WE ALSO MAKE THE CHEAPEST AND STRONGEST REVERSIBLE BOLTED TRAYS IN THE MARKET.

THE CLERK GAS ENGINE CO.,

Main Office, 1012, 1014, 1016, 1018 Filbert St., Philadelphia, Pa.

WM. W. GOODWIN, Prest. E. STEIN, Sec. S. LEWIS JONES, Asst. Sec. A. J. DOTY, Supt.

The utility and convenience of the Gas Engine being no longer an open question, it only remains now for intending purchasers to select the BEST. We claim for the CLERK GAS ENGINE that it is equal to any other manufactured as regards steadiness in running, simplicity, and ease of keeping in repair, and that it gives the greatest amount of power for the least money (both in first cost and expense of running) of any engine made. In support of this claim we refer to the test of the Gas Engines made under the direction of the American Institute of New York, in December, 1885, and heretofore published in these columns. These engines are especially adapted for continuous running under heavy loads, and we can refer to Engines which have run 22 hours a day for months at a time

Made in Sizes of 5, 10, 15, 20, and 25 Horse Power. All Engines Guaranteed for One Year.

ENGINEERS.

P. D. WANNER, Chairman. A. H. MELLERT, Mangr. of Wks.
R. B. KINSEY, Secretary. F. A. KNOPP, Treasurer.

MELLERT FOUNDRY & MACHINE CO. Ltd. and READING FOUNDRY CO., Ltd.

Reading, Pa.

Specials—Flange Pipe, Valves and Hydrants Lamp Posts, Retorts, etc.

General Foundry and Machine Work.

JOHN FOX, Selling Agent. **160 Broadway, N.Y**

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

BRANCH AND SPECIAL CASTINGS.

Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS.

Columbus, Ohio.

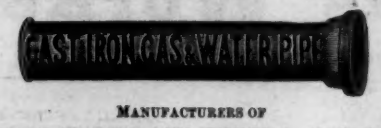
M. J. DRUMMOND,

SPECIAL CASTINGS AND LAMP POSTS.

Office, Corbin Building, 192 Broadway, N. Y.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.



MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS
FOR WATER AND GAS.

JOS. R. THOMAS,

No. 42 Pine Street, N.Y. City.

CONSULTING AND CONSTRUCTING

Gas Engineer and Contractor.

PLANS, SPECIFICATIONS, AND ESTIMATES FURNISHED.

Contracts taken for all Appliances required at a Gas Works,

Either for New Works or Extensions to Old Plants.

WM. MOONEY

(Successor to WM. FARMER)

No. 94 Liberty St., N Y. City.

GAS ENGINEER AND CONTRACTOR FOR THE ERECTION OF GAS WORKS, OR APPARATUS OF ANY CAPACITY.

Plans and Specifications Furnished.

WM. GARDNER,

Gas Engineer,

Lewis Block, Room 20, Pittsburgh, Pa.

Those who intend to make alterations in existing gas plants, or who contemplate the erection of new works, will find to their interest to open correspondence with the above. Plans made and estimates furnished.

GAS AND WATER PIPES.

SAM'L R. SHIPLEY, Pres.
HENRY B. CHEW, Tre

JAS. P. MICHELLON, Sec.
WM. SEXTON, Supt.

GLOUCESTER IRON WORKS,

GLOUCESTER CITY, N. J.

Cast Iron Gas & Water Pipes, Stop Valves, Fire Hydrants, Gasholders. &c.

Office, Rooms 61 and 63 Bullitt Building, 131 S. 4th St., Phila., Pa.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM TWO TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

DENNIS LONG & COMPANY,

LOUISVILLE, KY.,

Manufacture Exclusively

CAST IRON GAS & WATER PIPE & SPECIAL CASTINGS

OF ALL SIZES.

King's Treatise on Coal Gas.

A stan ard text-book for the Engineers and Managers of Gas Works, and for all who are concerned or take an interest in the manufacture and distribution of Coal Gas, and in the utilization of the Secondary Products resulting therefrom; treating also of the Gas Engine, and of Gas Cooking and Heating Appliances

In 3 Vols. Price per Vol., $10. Sold either by Volume or in Sets.

A. M. CALLENDER & CO., 42 Pine St., N. Y.

RETORTS AND FIRE BRICK. RETORTS AND FIRE BRICK. RETORTS AND FIRE BRICK.

J. H. CAUTIER & CO..
CORNER OF
GREENE AND ESSEX STREETS,
JERSEY CITY, N. J.
MANUFACTURERS OF
Clay Gas Retorts,
Gas House Tiles,
Fire Bricks, Etc. Etc.
Ground Clay, Fire Brick and Fire Sand in Barrels,
J. H. GAUTIER. C. E. GREGORY. C. E. GAUTIER.

BROOKLYN
Clay Retort & Fire Brick Works,
(EDWARD D. WHITE & CO.)
Manufacturers of Clay Retorts, Fire Brick, Gas House and other Tile.
VAN DYKE, ELIZABETH, RICHARDS & PARTITION STS.
Office, 88 Van Dyke St., Brooklyn, N. Y.

LACLEDE FIRE BRICK MFG. CO.,
MANUFACTURERS OF
Fire Brick, Gas Retorts,
AND
ST. LOUIS STANDARD SEWER PIPE.
Blast Furnace and Cupola Linings, every description of Fire Clay Material, Fire Clay Flue Linings, Chimney Tops Dry Milled and Crude Fire Clays, etc.
OFFICE AND DEPOT
901, 903, and 905 Pine Street,
ST. LOUIS, MO.

ESTABLISHED IN 1843.
B. KREISCHER & SONS,
OFFICE FOOT OF HOUSTON ST., E.R., N.Y.
Gas Retorts,
TILES, FIRE BRICK.
AND EVERYTHING IN THE FIRE CLAY LINE.

MANHATTAN
FIRE BRICK & ENAMELLED CLAY
RETORT WORKS
ADAM WEBER.
CLAY GAS RETORTS
AND RETORT SETTINGS
FIRE BRICKS, TILES, ETC.,
Office and Works, 15th Street and Avenue C., N. Y.

Works,
LOCKPORT STATION, PA.
—ESTABLISHED 1864.—
JAMES GARDNER, JR.,
Office, Rooms 19 & 20, Lewis Block,
PITTSBURGH, PA. P. O. Box 373.
Successor to WILLIAM GARDNER & SON.
Fire Clay Goods for Gas Works.
H. A. NORTON, No. 4 CENTRAL STREET, BOSTON, MASS., Agent for the New England States.

GEO. C. HICKS, Prest. **CHICAGO** CHAS. A. REED, Sec. & Treas.
Retort and Fire Brick Co.,
MANUFACTURERS OF
Fire Clay Goods of all Kinds,
AND BEST QUALITY ONLY.
Regenerative Furnaces & Water Gas Goods.
45th St., Clark to La Salle, Chicago.

GEROULD'S IMPROVED RETORT CEMENT.
A Cement for patching retorts, putting on mouthpieces, and making up all bench-work joints. This Cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick. For recommendations and price list address
C. L. GEROULD & CO.,
5 & 7 Skillman St., Brooklyn, N. Y.
Western Agent, H. T. GEROULD, Mendota, Ill.

Parker-Russell Mining and Mfg. Co.,
CITY OFFICE,
Mermod-Jaccard Bldg., Rooms 307 & 308,
Broadway & Locust St., St. Louis, Mo.
PROPRIETORS OF THE
OAKHILL GAS RETORT & FIRE BRICK W'KS
Our immense establishment is now employed almost entirely in the manufacture of
Materials for Gas Companies
We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We have the *exclusive Agency for the West* of the celebrated
Kloenne-Bredel Full Depth and Semi-Recuperator Benches,
And also furnish and build
Our Own Styles Semi-Recuperator Furnaces for the use of Coal or Coke as fuel.

THOS. SMITH, Prest. AUGUST LAMBLA, Vice-Prest. & Supt.
BALTIMORE
RETORT & FIRE BRICK CO.
MANUFACTORY AT
LOCUST POINT BALTIMORE, MD.
Clay Retorts, Blocks & Tiles
FIRE BRICK, FIRE CLAY,
AND FIRE CEMENT.
Red and Buff Ornamental Tiles and Chimney Tops. Drain and Sewer Pipe (from 2 to 30 inches). Baker Oven Tiles 12x12x2 and 16x16x2.
WALDO BROS., 88 WATER ST., BOSTON, MASS
Sole Agents the New England States.

Boston Fire Brick Works Manufacturers of **Gas Retorts and Settings**
Under the Personal Supervision of MR. GEO. C. HICKS late of Chicago.
Fire Clay Goods of all kinds. Akron Sewer Pipe, Lime, Cement, etc. Agts. for the Arc Gas Lamp & Governing Gas Burners.
Send for Circulars and Prices to
FISKE, COLEMAN & CO., Managers, No. 62 Congress Street, Boston, Mass.

FRED. BREDEL, C. E.,

Contractor for the Complete Erection and Equipment of Gas Works.

Sole Proprietor of the KLOENNE PATENTS for North America.

Gas Condensing and Purifying Machine.

Doing all the Work Between Exhauster & Oxide Purifier.

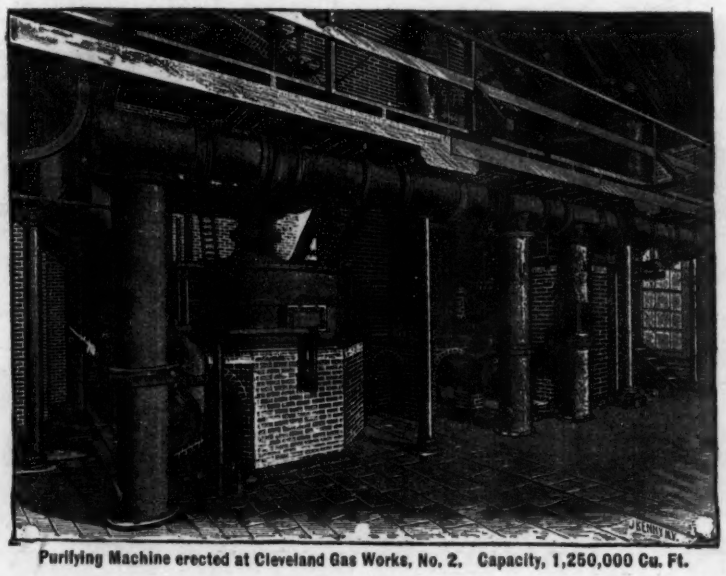
No Condensers Required.

No Naphthaline or Pitch is Formed.

HIGHER CANDLE POWER.

Tar & Ammonia Washers

WATER GAS WASHERS.



Purifying Machine erected at Cleveland Gas Works, No. 2. Capacity, 1,250,000 Cu. Ft.

RECUPERATIVE FURNACES.

Adapted to Retort Houses With or Without Stage Level.

Over 1,400 Retorts Now in Use in America.

Inclined Retort Benches.

Refers, by permission, to Mr. Eugene Vanderpool, Newark, N. J., and Mr. E. G. Cowdery, Milwaukee, Wis.

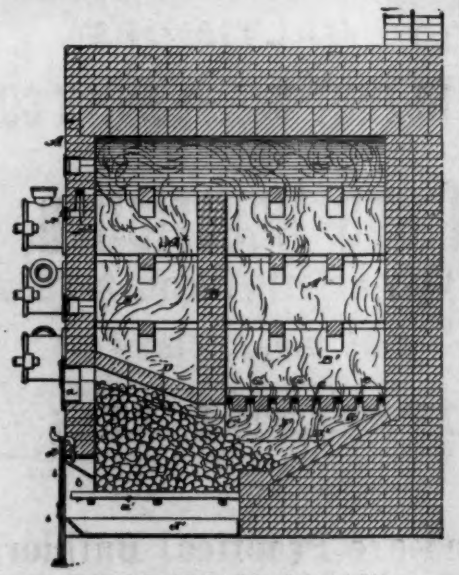
For further information address

FRED. BREDEL,

No. 208 East Seventeenth Street, - - - - New York City.

FLEMMING'S

Generator-Gas Furnace



Materials furnished and Benches erected by

J. H. GAUTIER & CO., - Jersey City, N. J.

Address as above, or D. D. FLEMMING, Jersey City, N. J.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.

OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

PATENTS.

FRANKLIN H. HOUGH

Solicitor of American & Foreign Patents.

925 F. ST., WASHINGTON, D. C.

(NEAR U. S. PATENT OFFICE.)

Personal attention given to the preparation and prosecution of applications for Letters Patent. All business before the U. S. Patent Office attended to for moderate fees. **No Agency in the United States possesses superior facilities for obtaining Patents,** or for ascertaining the patentability of inventions. Copies of patents furnished for 25 cents each. Correspondence solicited.

Simpkin & Hillyer

RICHMOND, VA.

MANUFACTURERS OF

Gas Works Apparatus

BENCH CASTINGS, CONDENSERS,

Scrubbers, Purifiers, Dry Center Seals,

FOUR-WAY VALVES, GAS VALVES,

SULPHATE OF AMMONIA APPARATUS, TANKS, ENGINES, BOILERS, PUMPS, ETC., ETC.

Plans, Specifications and Estimates furnished for new works, or alteration of old works. Correspondence solicited. Works, Newport News, Va.

FRIEDRICH LUX,

Ludwigshafen am Rhein and London.

Lux Mass

GAS GOVERNORS,

Gas Balance.

NEWBIGGING'S HANDBOOK FOR GAS ENGINEERS AND MANAGERS.

The present (the fifth) edition marks an important advance on those that have gone before. Considerable additions have been made to the text, and much of it has been rewritten and otherwise improved. Price, cloth, $6.

A. M. CALLENDER & CO., 42 Pine St., N. Y.

DAVIS & FARNUM MFG. CO.,

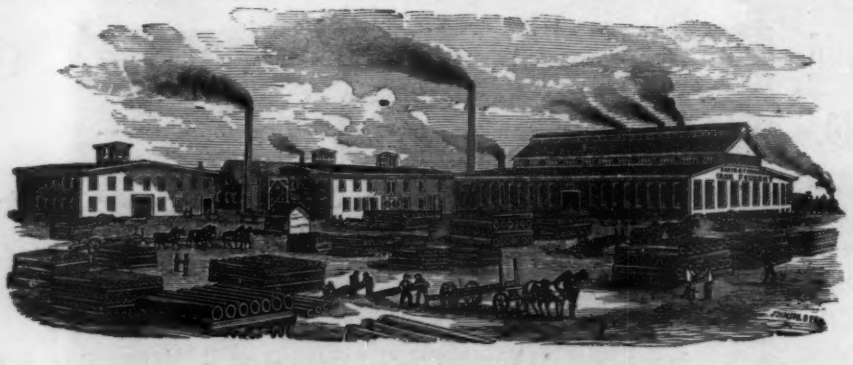
WALTHAM, MASS.

PRINCIPAL OFFICE AND WORKS, Waltham, Mass. BOSTON OFFICE, Room 55, Mason Building, 70 Kilby Street.

SINGLE, DOUBLE, AND TRIPLE LIFT

Gasholders.

OF ANY CAPACITY.



TUBULAR, PIPE, AND SINUOUS FRICTION

Condensers.

OF ALL SIZES.

IRON ROOF FRAMES AND FLOORS.

Purifying Boxes, Center Seal or Valve Connections, Bench Work.

Reversible Lime Trays.

SELF-SEALING AND PRESSED STEEL MOUTHPIECE LIDS.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Plant.

—ALSO—

Gas and Water Pipe, Flanged Pipe,

Sugar House Work, and Special Castings of all Descriptions.

Established 1861. Incorporated 1881.

KERR MURRAY MFG. CO.,

FORT WAYNE, IND.

Those who are in need of

Holders or Gas Works Apparatus of any Description,

AND OF THE LATEST IMPROVEMENTS,

will find it to their interest to

GET AN ESTIMATE FROM US

before placing their order.

As we make a Specialty of this Class of Work, and are Practical Builders and Manufacturers of same,

with our long years of experience in the business,

WE CAN GUARANTEE YOU SATISFACTION.

Estimates, Plans and Specifications Furnished on Application.

BARTLETT, HAYWARD & CO.

Baltimore, Md.

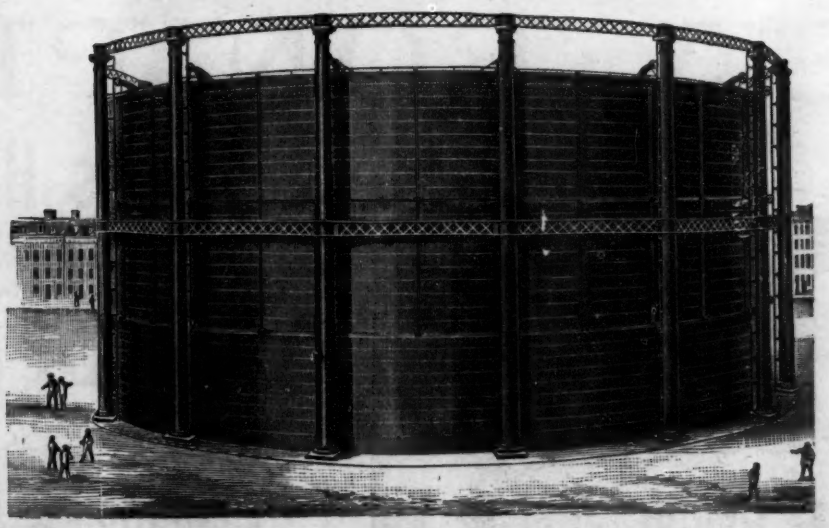
Triple Double, & Single-Lift
GASHOLDERS.

Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS.



PURIFIERS.

CONDENSERS.

Scrubbers.

BENCH CASTINGS.

OIL STORAGE TANKS.

Boilers.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSABLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

Munich Regenerative Furnace, System Drs. Schilling & Bunte.

HAZELTON BOILERS.

Gas Works Designed and Constructed.

Pascal Iron Works. ESTABLISHED —1821.— Delaware Iron Works.

MORRIS, TASKER & CO.,

INCORPORATED.

OFFICE, 224 SOUTH THIRD STREET, - - PHILADELPHIA, PA.

CONTRACTORS, BUILDERS, AND MANUFACTURERS OF

Gas, Water & Sugar Works

Bench Castings.

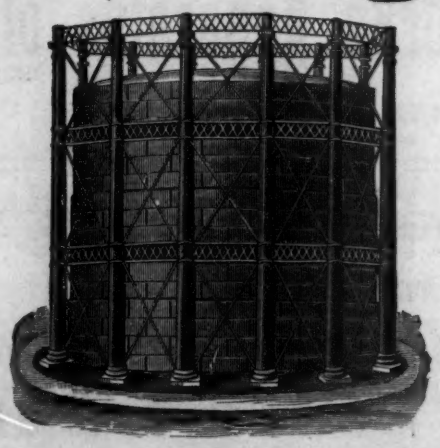
Condensers.

Scrubbers.

Purifiers.

Hyd. Carriages.

Iron Floors,



Iron Roofs.

Street Stops,

Valves, etc.

Stand-Pipes.

Water & Oil

Tanks, all Sizes.

Single, Double, and Triple-Lift Gas Holders.

SELF-SEALING RETORT LIDS. STAMPED STEEL RETORT LIDS.

Locomotive Water Columns, Filters, etc. Boiler Tubes, Wrought Iron Pipe & Fittings

Plans, Specifications and Estimates for all kinds of Machinery furnished on application.

Foundries & Works, MILLVILLE, FLORENCE, and CAMDEN, N. J.

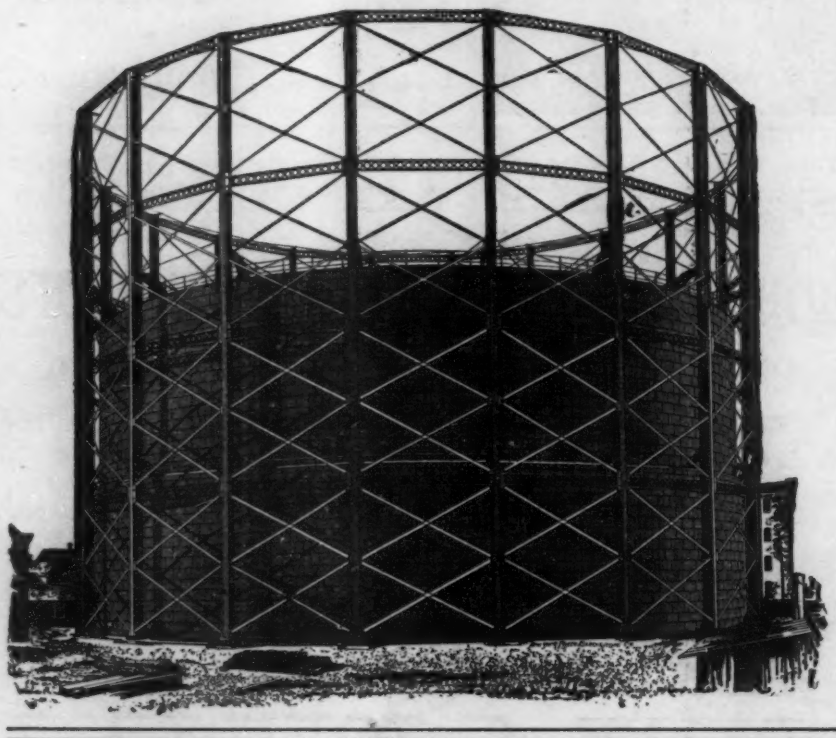
R. D. WOOD & CO.,

Engineers, Iron Founders, and Machinists.

400 Chestnut St., PHILADELPHIA, PA.

MANUFACTURERS OF

CAST IRON PIPE,



Gas Holders,

SINGLE, DOUBLE, AND TRIPLE LIFTS, WITH OR WITHOUT WROUGHT IRON OR STEEL TANKS.

PURIFIERS, CONDENSERS.

Scrubbers.

BENCH WORK.

Iron Floors and Roofs, Plate Girders.

Heavy Loam Castings.

HYDRAULIC WORK.

Lamp Posts, Valves, Etc.

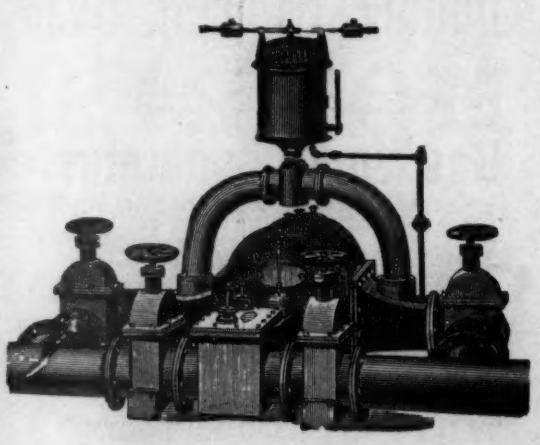
SMITH & SAYRE MFG. COMPANY,

G. G. PORTER, Prest. *245 Broadway, N. Y.* CHAS. W. ISBELL, Sec'y.

Machinery & Apparatus for Gas Works

Drawings, Plans, and Estimates Furnished for the Improvement, Extension, or Alteration of Gas Works, or for the Construction of New Works.

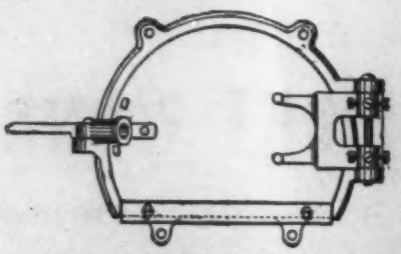
Mackenzie's Patent Rotary and Steam Jet Gas Exhausters, Governors, Compensators, Condensers, Washers, Scrubbers. Isbell's Patent Automatic Street Pressure Governor, Gas and Water Valves, Hydraulic Main Dip Regulator, Bench Castings, etc. Purifying Boxes and "Standard" Scrubbers. Isbell's Patent Self-Sealing Retort Doors.



THE BRENNER SELF-SEALING RETORT DOOR.

Simple, Strong, and Durable.

CLOSES ABSOLUTELY TIGHT & IS LOCKED BY A CAM LEVER. ALL NECESSARY ADJUSTMENT FOR WEAR PROVIDED.



Brenner Self-Sealing Retort Door.

BUILT BY

SMITH & SAYRE MFG. CO.,

No. 245 Broadway, - - - - New York City.

WILLIAM B. LUNDIE, Superintendent of the 42d Street Station of the Consolidated Gas Company, of New York, writes, under date of Jan. 4, 1889:

"We have 320 Brenner Self-Sealing Lids in use at this Station, built by the Smith & Sayre Mfg. Co. They require very little attention, and are the best of the kind that I have seen, giving entire satisfaction."

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.

JAMES R. FLOYD & SONS,

(SUCCESSORS TO HERRING & FLOYD)

Oregon Iron Works,

W. 20th & 21st. Sts., bet. 10th & 11th Avs.,

NEW YORK CITY.

Engineers and Contractors

FOR THE

CONSTRUCTION OF GAS WORKS.

MANUFACTURERS OF

All Kinds of Castings and General Ironwork

FOR

GAS APPARATUS.

Bench Castings, Regenerative and Half Regenerative Furnace Castings.

Condensers, Scrubbers, Purifiers, Street Drips and Connections,

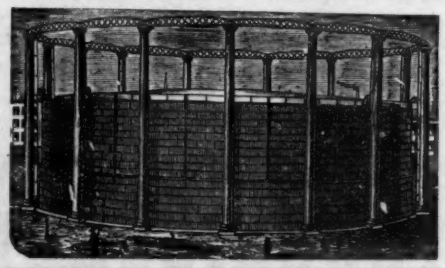
Valves,

Hydraulic Hoisting Purifier Carriage, Self-Sealing Retort Lids, Improved Valve Stand and Indicator, Seller's Cement.

Plans, Specifications, and Estimates furnished for Construction of New or Alteration of Old Works.

CONTINENTAL IRON WORKS.

THOS. F. ROWLAND, Prest. WARREN E. HILL and CHAS. H. CORBETT, V.-Prests. THOS. F. ROWLAND, JR., Sec. & Tr



P. O. Station G., BROOKLYN, N. Y.

ENGINEERS AND MANUFACTURERS OF

Gas Holders

CONDENSERS, SCRUBBERS, VALVES,

PURIFIERS, SELF-SEALING RETORT LIDS

Hydraulic Mains,

And all other articles connected with the manufacture and distribution of Gas.

H. RANSHAW, Prest. & Mangr. WM. STACEY, Vice-Prest. T. H. BIRCH, Asst. Mangr. R. J. TARVIN, Sec. & Treas.

STACEY MFG. CO.,

MANUFACTURERS OF

Single and Telescopic Gasholders,

IRON ROOFS, BRIDGES, LAMP POSTS,

Water and Oil Tanks, Coal Elevator Cars,

COKE CRUSHERS, BENCH CASTINGS,

And all kinds of Wrought and Cast Iron Work used in the erection of Coal and Oil Gas Works Rolling Mill Machinery and Heavy Castings a Specialty.

Foundry: 33, 35, 37 & 39 Mill Street.

Wrought Iron Works: 16, 18, 20, 22, 24 & 26 Ramsey Street.

Cincinnati, Ohio.

Bouton Foundry Co.,

FOUNDERS AND MACHINISTS,

CHICAGO, ILL.

Gas Works Apparatus,

PURIFIERS, CONDENSERS,

Bench Work

SPECIALS, LAMP POSTS,

SCRUBBERS,

Iron Roofs and Floors.

Plans and Estimates furnished for new works or extensions of old works.

1842. # DEILY & FOWLER, 1890.

Laurel Iron Works.

Address, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

GASHOLDERS,

Single and Telescopic.

Holders Built 1884 to 1888, Inclusive:

Newport, R. I.	Long Island City, N. Y	Port Chester, N. Y.	Malden, Mass.	West Chester, Pa. (2d
Portland, Oregon.	Macon, Ga.	New Rochelle, N. Y.	Paducah, Ky.	Lancaster, Pa. (3d
Allegheny, Pa. (3d.)	York, Pa.	Salem, N. J. (3d)	Norwich, Conn.	Tacony, Pa. (two)
Atlanta, Ga. (2d.)	Chester, Pa.	Omaha, Neb. (2d)	Seattle, W. T.	Mount Vernon, N. Y.
N.Y.City (Central Gas Co)	Hazleton, Pa. (2d.)	Lynn, Mass. (2d)	San Diego, Cal.	Binghamton, N. Y.
Lynchburg, Va. (2d.)	Staten Island, N. Y.	Little Rock, Ark.	Northern Gas Lt. Co., of	Concord, N. H.
Saylesville, R. I.	Saugerties, N. Y.	Irvington, N. Y.	New York. N. Y.	Dover, Del. (2d)
Rondout, N. Y.	Clinton, Mass. (Lan. Mills)	South Boston, Mass.	Westerly, R. I.	Calais, Me.
Atlantic City, N. J.	Chattanooga, Tenn.	Rye, N. Y. (2)	Willimantic, Conn	New London, Conn. (2d)
Augusta, Ga.	Galveston, Texas. (3d.)	Woodstock, Ont.	Montclair, N. J.	West Chester, N. Y.
Waltham, Mass. (2)	Omaha, Neb.	Malden, Mass.	Attleboro, Mass.	Bay Shore, L. I.
Mahanoy City, Pa.	Fort Plain, N. Y.	Staten Island, N. Y. (2d)	Santa Cruz, Cal.	Washington, D. C.
New Castle, Pa.	Brunswick, Ga.	Woodstock, Ont.	Erie, Pa. (2d)	

WM. HENRY WHITE,

No. 32 Pine Street, - - - New York City.

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited. Plans and Estimates Furnished.

GAS COALS. CANNEL COALS. GAS ENRICHERS.

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

228 & 229 Produce Exchange, New York.

Cable Address, "PERKINS, NEW YORK." Post Office Box 3695, New York.

GENERAL SALES AGENTS FOR

The Youghiogheny River Coal Company's

OCEAN MINE YOUGHIOGHENY GAS COAL.

HON. W. L. SCOTT, Prest. M. H. TAYLOR, Vice-Prest.

This Colliery is located at SCOTT HAVEN, PA., in the center of the Youghiogheny Gas Coal District, and produces the ONLY RELIABLE YOUGHIOGHENY COAL for gas purposes. (See Map on p. 87 of this JOURNAL, Feb. 16, '85.)

POINTS OF SHIPMENT,

Locust Point, BALTIMORE. Pier No. 62, PHILADELPHIA.

Also, SOLE AGENTS for the

BRECKENRIDGE CANNEL,

OF KENTUCKY.

Within the past two years we have delivered this Cannel to over ONE HUNDRED COMPANIES IN THIRTY-THREE DIFFERENT STATES, and it is now in use in some of the large Gas Works

On the Continent and in South America,

where it successfully competes with the Australian Shale. It is the ONLY AMERICAN GAS CANNEL of sufficiently high grade to warrant EXPORTATION TO EUROPE AND SOUTH AMERICA, and it is the only economical substitute for OIL OR NAPHTHA. ONE GROSS TON will produce

10,000 Cubic Feet of 75 Candle Gas,
or 12,500 " " 60 " "
or 15,000 " " 50 " "
} equal to { 750,000 Candle Feet of Gas, and 26 Bushels of merchantable Coke weighing 900 Pounds

This is the ONLY GAS CANNEL that will produce a REALLY MERCHANTABLE COKE. It can be delivered in parcels of one carload or more to any point in the United States or Canada. Cargo shipments of any size required can be made from NEW YORK, PHILADELPHIA, BALTIMORE, or NEWPORT NEWS. Samples will be sent and particulars of price, etc., forwarded upon application to above address.

JAMES & WILLIAM WOOD,

Gas and Cannel Coal Contractors,

No. 40 St. Enoch Sq., Glasgow. No. 2 Talbot Court, London.

Proprietors of the BATHVILLE COLLIERIES (which produce the celebrated BOGHEAD CANNEL), Shields, Shieldmuir, Drumpeller, and other Collieries. This Firm offer

STANDARD CANNELS,

Unequaled as Gas Enrichers.

Analyses, prices, and all further information furnished on application to

Agency for U.S., Room 70, Nos. 2 & 4 Stone St., N.Y. City.

The Standard Oil Company,

REFINERS OF

NAPTHA AND GASOLINES.

ALSO MANUFACTURERS OF

A Special Grade of Naptha for Gas Companies

FOR ENRICHING COAL GAS.

Correspondence solicited.

No. 43 Euclid Avenue, Cleveland, Ohio.

To Gas Companies.

We make to order CAP BURNERS to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,

948 N 8th Street, Phila., Pa.

COKE CRUSHERS. GAS COALS. GAS COALS.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

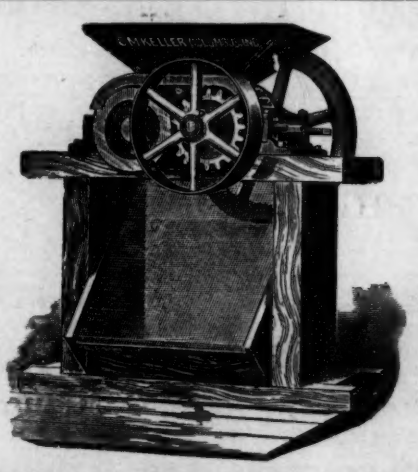
DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, Clarksburg, Harrison Co., W. Va.
WHARVES, Locust Point, Baltimore, Md.
OFFICE, 225 E. German St., " "

ROUSSEL & HICKS, 71 Broadway, N. Y. } AGENTS. } BANGS & HORTON, 60 Congress St., Boston.



Keller's Adjustable Coke Crusher

SIMPLE, STRONG, AND DURABLE.

O. M. Keller, Sec. & Supt. Gas Lt. & Coke Co. Columbus, Ind.

Correspondence Solicited.

Fuel and Its Applications.

By E. J. MILLS, D.Sc. F.R.S., and F. J. ROWAN, C.E., assisted by others, including Mr. F. P. Dewey, of the Smithsonian Inst., Wash., D. C.

7 PLATES, AND 607 OTHER ILLUSTRATIONS. ROYAL OCTAVO, PAGES XI, 802. HANDSOME CLOTH, $7.50.

A. M. CALLENDER & CO., 42 Pine St., N. Y.

King's Treatise on Coal Gas.

The most complete work on Coal Gas ever published

Three Vols. Bound, $30.

BOOKS.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR.

By GEORGE LUNGE. Price $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS.

By DAVID A. GRAHAM. 8vo., Cloth. Price $3.

Orders for these books may be sent to this office.
A. M. CALLENDER & CO.,
42 PINE ST., N. Y. CITY

GAS COALS. GAS COALS.

THE PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened & Prepared for Gas Purposes.

Their Property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

209 SOUTH THIRD STREET, PHILA., PA.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River; Pier No. 1 (Lower Side), South Amboy, N. J.

Chesapeake & Ohio Railway Coal Agency,

FOR THE SALE OF THE

Superior Kanawha Gas Coals, Cannelton Cannel,

Also, SPLINT AND STEAM COALS

From the Kanawha and New River Regions, on the line of the Chesapeake & Ohio R'way.

C. B. ORCUTT, General Agent, - - No. 1 Broadway (Room 217) New York City.

FRANCIS H. JACKSON, Prest. EDMUND H. MCCULLOUGH, V.-Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Penn.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J., WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

The American Gas Engineer and Superintendent's Handbook.

By WILLIAM MOONEY.

Consisting of Rules, Reference Tables, and Original Matter Pertaining to the Manufacture, Manipulation, and Distribution of Illuminating Gas.

350 Pages, Full Gilt Morroco. $3.00.

A. M. CALLENDER & CO., 42 Pine St., N. Y.

JOHN J. GRIFFIN & CO.,

Nos. 1513, 1515, 1517 & 1519 Race Street, PHILADELPHIA.
52 Dey St., NEW YORK. 75 N. Clinton St., (FRED. R. PERSONS, Mangr.) CHICAGO.

MANUFACTURERS OF

METERS FOR MEASURING GAS

IN ANY VOLUME.

Provers, Gauges, Registers, Etc., Etc.

EXPERIMENTAL APPARATUS FOR QUANTITATIVE AND QUALITATIVE ANALYSIS.

Careful and Prompt Attention paid to Repairing of all kinds of Meters and Apparatus.

Estimates Cheerfully Furnished.

Dry Gas Meters.

With 40 years' experience and the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS,

No. 153 Franklin Street, Boston, Mass.,

MANUFACTURER OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges, Pressure and Vacuum Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Patent Cluster Lanterns for Street Illumination.

HAROLD J. BELL. S. LEWIS JONES.

BELL & JONES,

No. 12 North Ninth Street, Philadelphia, Pa. Works at Royersford, Pa.

MANUFACTURERS OF

GAS METERS, STATION AND EXPERIMENTAL METERS,

Meter Provers, Pressure Gauges, and All Other Gas Appliances in Our Line.

WE REPAIR ALL KINDS AND MAKES OF METERS, AND THE WORK GUARANTEED.

High Pressure Meters for Natural Gas, in Iron Cases, guaranteed to stand 300 lbs. Pressure. Gas Cooking and Heating Stoves, Hot Plates, Cake Griddles, Waffle Bakers, Boiling Stoves, Laundry and Tailors' Iron Heaters. Hotel and Cafe Ranges a Specialty.

Correspondence Solicited. **Estimates Furnished.**

A. HARRIS. E. L. HARRIS. J. A. HARRIS.

Established 1849.

HARRIS BROS. & CO.,

Twelfth and Brown Streets, Philadelphia.

Manufacturers of Wet and Dry Gas Meters,

STATION METERS, METER PROVERS,

EXPERIMENTAL METERS, SHOW OR GLAZED METERS,

Pressure and Vacuum Registers, Gauges, Photometers, Drip and Bell Pumps, Etc., Etc.

PROMPT ATTENTION GIVEN TO ALL ORDERS. METERS THOROUGHLY REPAIRED. ESTIMATES FURNISHED FOR STATION METERS OF ALL SIZES. CORRESPONDENCE SOLICITED.

GAS METERS. GAS METERS. GAS METERS.

GEO. J. McGOURKEY, Prest. WM. H. McFADDEN, Vice-Prest. (Phila.) WM. N. MILSTED, Gen. Supt. and Treas. (New York). WM. H. DOWN, Sec.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTER VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR & JET PHOTOMETERS.

Manufactories:
512 West 22d St., N. Y.
Arch & 22d Sts., Phila.

GAS STOVES.
SUGG'S "STANDARD" ARGAND BURNERS,
SUGG'S ILLUMINATING POWER METER,
Wet Meters, with Lizar's "Invariable Measuring" Drum.

Agencies:
177 Elm Street, Cincinnati.
244 & 246 N. Wells Street, Chicago.
810 North Second Street, St. Louis.
222 Sutter Street, San Francisco.

HELME & McILHENNY,

(Established 1848.)

GAS METER MANUFACTURERS,

Nos. 1339 to 1349 Cherry Street, Philadelphia, Pa.,

WET AND DRY GAS METERS. STATION METERS, EXPERIMENTAL METERS, METER PROVERS,

Center Seals, Pressure Registers, Governors, Indicators, Photometers, and all other kinds of Apparatus for use in Gas Works.

FOULIS' PATENT STATION AND DISTRICT GOVERNORS.

REPAIRING DEPARTMENT.—We employ a special force of skilled workmen repairing meters of **all makers.**

WM. WALLACE GOODWIN, President and Treasurer. E. STEIN, Vice-President. H. B. GOODWIN, Secretary and Superintendent.

THE GOODWIN GAS STOVE AND METER CO.,

Successors to W. W. GOODWIN & CO.

1012, 1014 and 1016 Filbert St., Phila., Pa. 113 Chambers St., New York City. 76 Dearborn, St., Chicago, Ills

WALDO BROTHERS, Agents, 88 Water Streets, Boston, Mass.

MANUFACTURERS OF

DRY AND WET GAS METERS,

Station Meters (square, cylindrical, or in staves), Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, etc., etc. Meter Provers (sizes 2, 5, and 10 feet), Pressure Gauges of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4, 6, and 9 inch), King's Pressure and Vacuum Gauges, Dry and Wet Center Seals, Dry and Wet Governors, Exhauster Governors, Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus complete. Also, Testing and Chemical Apparatus of all kinds, and of the most perfect description, for all purposes relating to Gas.

Manufacturers of the "SUN DIAL" GAS STOVES, for Cooking and Heating.

Goodwin's Improved Lowe's Jet Photometer. **Agents for Bray's Patent Gas Burners and Lanterns.**

Special attention to Repairs of Meters and all Apparatus connected with the business. All work guaranteed first-class in every particular. Orders filled promptly.

G. B. EDWARDS, Manager, New York. S. S. STRATTON, Manager, Chicago.

D. McDONALD & CO.,

GAS METER MANUFACTURERS.

(Established 1854.)

51 Lancaster St., Albany, N. Y. 34 & 36 West Monroe St., Chicago, Ill.

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS, PRESSURE GAUGES, ETC.

Also STAR GAS STOVES, RANGES, and HEATING STOVES.

We use only the very best materials, and employ the most skilled labor, and by our long experience (36 years) and personal supervision of every detail, we feel justified in assuring the public that our goods will give perfect satisfaction. Every Meter emanating from our establishment will bear the State Inspector's Badge, and will be fully warranted by us. Our Annual and Calendar will be sent to Gas Companies upon application.

WM. WALLACE GOODWIN, President. E. STEIN, Vice-President. H. B. GOODWIN, Sec. & Supt. G. B. EDWARDS, Mang'r, New York. S. S. STRATTON, Mang'r, Chicago.

THE GOODWIN GAS STOVE AND METER CO.,

1012-18 Filbert St., Phila., 113 Chambers St., N. Y., 76 Dearborn St., Chicago.

Agents, WALDO BROTHERS, 88 Water Street, Boston.

SOLE MANUFACTURERS OF THE

"SUN DIAL" GAS STOVES,

The Most Economical, Efficient, and Durable Gas Stove Made.

GAS COOKING STOVE, No. 8 C.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
37 in. high.	12 in. high.	12 in. high.	24 in. long.	36 in.
20 in. wide.	17½ in. wide.	18 in. wide.	21 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has four burners on top, and double oven burner.

Consumption of gas with all burners in use, 42 feet per hour, at 1 inch pressure.

The top is made in sections, so that a greater variety of cooking utensils may be used. By lifting out the covers and crosspieces and putting in a suitable forked ring, which is sent with each stove, a wash boiler or other large utensil may be set over two burners. Our **No. 87 GRIDDLE** also fits in the same position. The roasting oven is provided with a cast-iron door.

All Fittings are Nickel-Plated.

GAS COOKING STOVE, No. 7 B.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
31 in. high.	9⅝ in. high.	10 in. high.	21 in. long.	32 in.
17 in. wide.	14½ in. wide.	15 in. wide.	16 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has three boiling burners in the Top or Hot Plate, and one single oven burner.

This cut represents our New Style Cooking Stove. As will be seen, it has an ornamented cast-iron Base and Front, and extension shelves. The Oven Burner, which is atmospheric (unless otherwise ordered), is of an entirely new and improved pattern (patent). The ovens are of greater capacity than those of the old style. The Top, in conjunction with the Outlet Pipe, is designed to carry off all the products of combustion, if desired, but they are also supplied with a loose ring which converts it into an ordinary open top stove.

The consumption of this Stove is 35 cubic feet per hour at 1 inch pressure, with all Burners in use.

All Fittings are Nickel-Plated.

"RADIANT" BOILING STOVE, WITH REGENERATIVE BURNER.

Size, 6¼ inches diameter, 8 inches high. Consumption, 6 feet per hour at 1 in. pressure.

HOT PLATE, No. 111.

Size, 36 in. long, 12 in. wide, with three double burners, 6 taps.

Consumption, with all burners in use, 36 cubic feet per hour, with 1 in. pressure.

¾ in. supply pipe should be used where the pressure is 1 in. or over.